Journal of FORESTRY

APRIL 1951

Volume 49
Number 4

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VOLUME 49 • NUMBER 4 APRIL 1951

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The JOURNAL OF FORESTRY, established in 1917, is the official organ of the Society of American Foresters, but the Society assumes no responsibility for the statements and opinions expressed by contributors.

Publication office, 825 Mills Building, 17th Street at Pennsylvania Avenue N. W., Washington 6, D. C. Address all correspondence concerning editorial or business matters to JOURNAL OF FORESTRY, 825 Mills Building, 17th Street at Pennsylvania Avenue N. W., Washington 6, D. C. Published monthly. Subscriptions, $6 per year; single copies, 60 cents. Missing numbers will be replaced without charge provided claim is made within thirty days after date of the following issue.

The editors are not responsible for loss or damage of manuscripts and photographs while in transit or in their possession. All material submitted for publication should be accompanied by return postage.

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Journal of Forestry

Official Organ of the Society of American Foresters

Golden Anniversaries and Golden Opportunities

An Editorial

Lyle F. Watts
Chief, U.S. Forest Service

LAST YEAR the Society of American Foresters celebrated its golden anniversary. Four years ago was the fiftieth anniversary of the opening of the Biltmore Forest School, offering the first technical instruction in forestry in America. That year was also the fiftieth anniversary of the basic act providing for administration of the national forests. Yale School of Forestry was fifty years old last year. Four years hence the U. S. Forest Service will have its fiftieth birthday. And this year marks the half-century anniversary of yet another milestone—the establishment of the Bureau of Forestry in 1901.

Golden anniversaries in American forestry thus are coming along in great number these days. It was about fifty years ago, around the turn of the century, that forestry received its first great impetus in this country. That was when things began to happen, when the conservation movement began to move.

Gifford Pinchot was the leader of the forestry movement, the great driving force for forestry, in those days. His crusading zeal, his dynamic leadership prodded forestry into activity. He gained for it national recognition. The momentum he gave to forestry can still be felt. It helps to carry forward the work of forestry even today.

I believe that history will recognize Gifford Pinchot as one of America's greatest men. I believe this because our resources will be among the major factors that determine our national destiny. In the long run, they may be the decisive factor. More than any battle, more than any swing of the political pendulum, the way we handle our resources will tell eventually whether our nation lives or dies. My own confidence that our nation will endure and progress is based in great part on the belief that we shall be wise enough to follow principles of conservation and wise use that were championed by Gifford Pinchot.

When the Bureau of Forestry came into being in 1901, its staff comprised practically all the men who could be called professional foresters in the United States. Furthermore, its 81 student assistants represented most of the foresters then in the making. In his book, *Breaking New Ground*, Pinchot described the activities of this enthusiastic band of student workers. Many of these "green youngsters," as he called them, became leaders in the forestry profession in America.

Governmental forestry work actually had started a quarter of a century earlier, with the appointment of Dr. Franklin B. Hough to investigate and report on forest conditions and trends in the United States. The American Forestry Association was organized in 1876, the same year that Dr. Hough was appointed Commissioner of Forestry. Soon a number of state and local forestry associations also were formed, and these helped to bring about the establishment of state forestry boards or commissions in several states.

After the turn of the century, forestry moved forward in rapid strides. American forestry now has to its credit a half-century of notable progress. We have made much headway. Our national-forest system that was a struggling infant fifty years ago is today a going concern. Its returns to the public in timber production, livestock production, wildlife, recreation, water supplies, flood control, and other products and services are substantial, and they are steadily increasing. Many national-forest contributions to local community and national welfare are of inestimable value. They cannot be reckoned in dollars and cents. But on a cash basis alone, the national forests this year will return to the U. S. Treasury more than the total appropriation for their protection and management.

We have many strong, competent state forestry departments. Fifty years ago there was almost no systematic protection of forests from fire in this country; today state forestry agencies are conducting a cooperative program that provides organized protection for some 360 million acres. The states have developed many fine state forests; they are doing a good job along many lines for the advancement of forestry.

Private forestry has made noteworthy gains. Fifty years ago, only an insignificant amount of private forest land had been put under management. The Forest Reappraisal in 1945 showed that some 108 million acres were being managed under cutting practices that rated at least fair. That was about 36 percent of the total operating commercial forest land in private ownership. Some 4,000 professional foresters are now reported to be in industrial employment, of whom probably more than half are engaged, full or part time, in technical forest management work. The forest management programs of many lumber and pulp and paper companies are excellent. Others are

not so good. The situation on most of the 261 million acres in small ownerships is far from satisfactory. But at least a promising start has been made in the first half-century.

Research has been steadily expanding the knowledge upon which these advances in forestry are based. The total expenditures for forestry and forest products research by the federal government, state agencies, private institutions and colleges, and industrial corporations in 1949 approximated $17,000,000. In that year more than 600 cooperative agreements for the conduct of research were in effect between the Forest Service and industrial concerns, state agencies, and others. We don't know all the answers in forestry yet, but we certainly do know much more than we did fifty years ago.

All these things add up to a considerable total of achievement in forestry. We have no reason to apologize for lack of accomplishment in our profession.

But actually our job has just started. We cannot now rest on our laurels. Indeed, our forests as a whole are now poorer in quality than they were half a century ago. The present growth of timber is below the amount the forests should ultimately be growing. Much forest range land has deteriorated. Many important watersheds are in critical condition. Inadequate watershed protection is costing us a huge price every year, in heavy flood losses, poorer quality of water, erosion, and sedimentation.

In spite of the progress we have made, accomplishment in forestry has not yet caught up with resource depletion. In the past fifty years the foresters' total job has actually increased in its dimensions.

The job, indeed, has been made even bigger and more urgent by the national defense emergency which the world situation has forced upon us. The present emergency may be of long duration, and emergency conditions may be the normal situation for a long time to come. If our country is to carry the tremendous burden of long-term defense effort that now confronts us, our natural resources must be kept strong, and they must be made stronger—much stronger—than they now are.

The foresters' job is to make forests produce abundantly and continuously the products, services, and benefits needed from them. So long as the bulk of our nation's forests are not in condition so to produce and are not under permanent management for such production or service, the total forestry job looms as a continuing challenge. The job calls for application of good forestry practice to many more millions of acres, for rehabilitation of large areas of deforested-lands, for intensification of protection and management, both on public and private forest lands. It calls for expanding knowledge and increasing skills. It calls for many, many more foresters.

While we can take pride in the progress made over the past half-century, it is only a beginning of what we can do in the next half-century. As we observe golden anniversaries, we should look forward to golden opportunities.

The total job ahead is a big challenge, and it is a big opportunity. We foresters cannot do the job alone. We need more backing and support from industry, from government, and most of all from the public. It is up to us to win that support. Foresters, not others, must provide the leadership for forestry.

For the pioneer foresters of fifty years ago, forestry was more than a job—it was a cause. Forestry, as it starts its second half century, needs a recharge of the fervor that characterized its early days.

❦❦❦

This is the second in a series of guest editorials, which will appear in the Journal during the year, by well-known personalities in the natural resource conservation movement.

The Relation of Forests to Our Water Supply[1]

A. R. Croft and Marvin D. Hoover
Foresters, Intermountain Forest and Range Experiment Station, Ogden, Utah, and Southeastern Forest Experiment Station, Asheville, N. C., respectively, Forest Service, U. S. Department of Agriculture.

THE FORESTRY PROFESSION must assume responsibility for water management of forest lands as well as for timber management. From the beginning, public support for conservation in this country was largely based on a concern for perpetuating timber and safeguarding water supply. However, foresters during the past 50 years have devoted most of their effort to producing timber; water yield has been given only slight consideration.

There are several reasons for this neglect of the water resource. First, the forester finds it easy to appreciate the value of timber because it is a crop harvested where he works, whereas, water is put to use a long way from the woods. Even more significant, the forester cannot easily show a cash benefit for anything done in the interest of water. Water appears to be a gift of the gods—free, unchangeable, inexhaustible. In his desire to get a return from other products he tends to pay scant attention to water production or the damage that may be done to a water user who is perhaps 200 miles downstream.

Then too, in forestry education, the way in which forestry practices influence quality and quantity of water has not been given adequate consideration.

But times have changed. Public concern and increasing demand for water is demonstrating to foresters that water from the lands they manage may have values equal to or greater than the timber.

To begin with, we know that a forest is more than just trees. Between the tree tops and their root tips is a complicated association of plants, animals, soil, climate, water, and physiography. These components through geologic ages have been integrated into a complex, or whole, that constitutes the forest.

The trees of the forest, by checking air movement, increasing humidity, and altering temperature and light, create a climate different from the over-all climate above them. This forest-made climate is an important factor in the existence and perpetuation of the forest complex.

Water is an intimate part of this complex. Indeed, water entering the forest as rain or snow, being intercepted by trees, penetrating the litter, duff, and soil, oozing from seeps and springs to form streams, is so closely associated with every part of the forest that it may be considered part of the forest complex itself. Streams under pristine conditions are adjusted to this complicated environment.

The forester can alter the quantity, quality, and timing of runoff by his management of vegetation and soils of the forest. This has been demonstrated both by observation and controlled experiments, a few examples of which will be presented in this paper. Before going into this subject, however, it will be helpful to consider briefly how forests function in water yield.

How Forests Function in Water Yield

A watershed may be considered a basin that receives intermittent precipitation and converts part of it to more or less sustained stream flow. In this process every square foot of land receives and disposes of water.

Water that enters the forest as precipitation is first stored. It is stored as snow, on leaves and branches of trees, in depressions on the soil surface, in the litter and duff, in the soil mantle as capillary water, and temporarily as free water in the cracks and pores of the litter, duff, and soil, and in fissures of the underlying rock.

The soil and geologic mantle is by far the greatest reservoir for water storage. This storage takes several forms. First, each foot of soil holds from 0.4 to 1 inch of water so tightly that it cannot be removed by plants or gravity. This unavailable water corresponds to the dead storage below the outlet of a water reservoir and ordinarily represents the minimum moisture content of the soil.

The soil also retains 2 or 3 inches of capillary water against the force of gravity but not against the pull of plants. It is this water, mainly, that plants use in growth. Maximum capillary storage is referred to as field moisture capacity.

The water stored temporarily in the cavities of the litter and duff and in the large pore spaces within the soil is called detention storage. It varies from 0.1 to 3 inches per foot depending on the amount and character of the litter and duff, and the depth and texture of the soil. This temporary storage is very important for it furnishes an emergency storage capacity for water in addition to that held in capillary form by the soil mantle. It is important when permeability of the soil is low because it prolongs the period of percolation. Except for this detention storage much water, at times, would flow quickly overland to stream channels rather than pass through the mantle as seepage flow. Direct overland runoff produces high and flashy stream flow, erodes the soil, and loads streams with sediment. It is destructive and undesirable. Water that penetrates the surface percolates more slowly through the soil to streams and gives less flashy and more sustained flow. Seepage flow is the normal manner of water yield from forested lands.

Undisturbed forest soils provide highly favorable conditions for seepage flow. At the surface are the organic layers grading gradually from the undecayed fallen leaves to a mixture of decomposed organic matter with mineral soil that pro-

[1] Presented at the annual meeting, Society of American Foresters, Washington, D. C., December 16, 1950.

tects the soil surface against rain drop impact and creates ideal conditions for infiltration of water. Roots ramify throughout the organic horizons and penetrate below to considerable depths. As these roots die and decay they form pipe lines that carry water quickly to lower depths and also contribute to the porosity of the soil.

Water from precipitation that is stored in the forest is disposed of in different ways: some is lost by evaporation from the foliage, litter, and from snow; some may flow overland to streams but under undisturbed conditions the amount is extremely small, if any; and finally, large quantities are removed by evaporation and transpiration. Any precipitation not disposed of by these processes passes through the soil mantle as free or gravitational water to streams or to ground water storage. No free water can pass through the soil mantle to generate stream flow, however, unless the soil is at field moisture capacity. Stream flow and ground water are then residuals of the precipitation, being that part not consumed by the forest.

Thus foresters, in having charge of key water yielding areas are in effect managing huge detention reservoirs. Considered strictly from the water yield point of view the objective is to get maximum amounts of water into the reservoir and, on the other hand, draw out as little as possible. This permits the maximum amount of the precipitation to percolate through the soil as seepage flow to streams.

How Forest Practices Affect Water Yield

The amount of water which enters and leaves the soil reservoir will be influenced by the way the forest is managed. From experiments in various parts of the country we are obtaining information that suggests the magnitude of changes in stream flow that may be achieved by management. Although these results do not apply directly to watersheds which differ in climate, soils, and geology from the test areas, the principles involved are rather universally applicable.

Total Water Yield

The factors that determine total water yield are expressed by the simple formula: water yield equals total precipitation minus (interception + evapo-transpiration ± storage). Let us consider briefly how each of these factors may be influenced by forestry practices.

Interception losses. — Water losses due to interception by forest stands range from 10 to 40 percent of the annual precipitation (*6*). It must not be assumed that elimination of interception results in equivalent increases in stream flow. Actually, most rains are so small they wet the soil only a few inches and the water is soon lost by evaporation or transpiration. These minor rains, therefore, have practically no immediate effect on water yield. Sometimes, however, even though rains are not large enough to raise the soil moisture to field capacity so that water can pass through to streams, they do tend to raise the moisture content of the soil. By so doing they decrease the seasonal soil moisture deficit so that less water from subsequent rains or snow is required to raise the soil moisture to field capacity. Thus reduction of summer rainfall interception by removal of timber may help increase water yield.

Experimental results indicate that where winter snowfall furnishes most of the runoff, it is possible to increase water yields by opening the stand to permit more snow to reach the ground. For example, in lodgepole pine at the Fraser Experimental Forest in Colorado, 26 percent more precipitation reached the ground as snow when all trees larger than 10 inches d.b.h. were cut (*8*). This saving increased water available for stream flow about 31 percent. In the same study it was found that light cuts and thinnings in young stands also decreased interception losses. It therefore appears that any cutting in similar areas can be expected to have some effect upon water yield. These results were obtained on sample plots and have not yet been tested on a watershed basis. Further research is needed to furnish the information necessary for practical use.

In certain humid regions, interception occurs at times when the soil is at field capacity. Under such conditions high interception is desirable because it reduces water available to streams and reduces peak discharges.

Evapo-transpiration. — Evapotranspiration as used in this paper refers to water lost from the forest floor by evaporation and water withdrawn by plants from the soil and geologic mantle and from ground water. These losses depend on many factors. Chief among these are climate, leaf area, extent and depth of roots, available water which is largely a function of soil depth, and proximity of roots to the water table.

Evaporation is less effective than transpiration as a medium of water loss because it decreases in rate with mantle depth. It is effective mainly in the upper 2 feet of soil. Transpiration, on the other hand, removes water from the entire root zone at a rather uniform rate regardless of depth. For example, in the Wasatch Mountains of Utah the moisture deficit created by evaporation in soil without plants during the growing season averaged about 4 inches while that of an aspen forest at the same site created a deficit three times as great (*3*). Evaporation was largely from the upper 2 feet of soil, but even at this depth about 1 inch of water per foot of soil was still available to plants at the end of the growing season.

Means of reducing the amount of water transpired by forest vegetation have been studied in the southern Appalachians and in the Wasatch Mountains of Utah. In the latter study, it was found that an aspen stand in a 0.1-acre plot during the growing season used all available water to a depth of 6 feet. On another plot where aspen was cut, but herbaceous vegetation left, only the available water in the upper 4 feet was removed. The moisture deficit in the fall was 12 inches under aspen as compared to 8 inches where aspen had been cut. Because moisture deficits must be replaced before water can flow through the soil, the difference of 4 inches represents the possible

gain in stream flow which could be obtained by replacing aspen by shallow-rooted herbaceous species. In evaluating these results for watershed application, it is important to consider soil depth. If the soil had been less than 4 feet deep both types of vegetation would have used all available water. In general, management can expect to decrease transpiration draft most effectively where soils are deep.

At the Coweeta Experimental Forest in western North Carolina, on two 40-acre watersheds which had an oak-hickory forest, stream flow was measured for 5 years and then the trees were cut (*5*). To prevent soil disturbance, no logging was done, the trees were left where they fell, and slash was scattered. The first year after cutting, stream flow was increased 17 area inches or 65 percent with the largest increases occurring during summer and fall months. On one watershed, regrowth has been kept to a minimum by annual mowings and the streamflow increase has been maintained. Because of the protection given to the soil, flood peaks have not been increased and flow is still from seepage and ground water. On the second watershed where natural regrowth has occurred, the flow 8 years later is still 20 percent greater than before treatment. Water yields were increased because, with the reduction in transpiration, summer rainfall was frequently sufficient to raise the soil to field capacity so that free water could pass through the soil to recharge the water tables which feed the stream.

There can be little doubt that water yield from forests can be materially increased or decreased as changes in forest cover alter water losses from intereception and evapotranspiration.

Distribution of Water Yield

Ordinarily stream flow is highest in spring and lowest in the summer. An increase in water yield in the summer when demand is high, is of great economic value in both semiarid and humid regions.

Reduction in evapo-transpiration from ground water along streams may also increase yield at times of low flow. At the Coweeta Experimental Forest, for example, cutting all trees less than 15 feet above the stream, increased stream flow 20 percent during the late summer months although only 12 percent of the watershed was cut (*4*). The treatment was most effective during periods of no rainfall. In the Wasatch Mountains of Utah, trees and other riparian vegetation consumed about one-third of the late summer stream flow from a 6,300-acre watershed (*2*). It is believed that about one-half of water lost could be saved by removing trees that have their roots in the ground water along the main stream channels.

Increase in water yield in late summer may have great value. For example, a study of the 5,000-square mile Merrimack River basin, about 70 percent forested, suggests that low water flows could be increased about 7 percent by improved forestry practices designed to increase seepage flow by reducing water losses from evaporation, transpiration, and quick surface runoff. If this could be done hydroelectric power companies estimate the value of the increased flows for power production to be $250,000 annually. In addition, the increased flow in summer would help relieve stream pollution.

Frost may have an important effect on distribution of water flow by causing water to flow overland quickly to streams rather than percolate through the soil and geologic mantle to streams. This was investigated in the Pocono Mountains of Pennsylvania on two adjacent watersheds—one 90, the other 40 percent forested. The 90 percent forested watershed produced the lowest peak discharges 21 out of 32 times. It also produced the highest summertime stream flows 20 out of 21 times. The more uniform stream flow on the densely forested area was closely associated with frozen soil. For example, during a rainstorm that followed a short freezing period, overland flow to streams was observed from nonforested pastured areas with frozen soil but not from forested lands where soils were not frozen. Where overland flow occurred small streams were highly turbid.

A recent study in California shows how forest cover may affect seasonal distribution of water by checking quick overland flow to streams, thus promoting seepage flow (*7*). A normal woodland-chaparral forest infiltrated the total precipitation of 60 inches, about 43 inches of which percolated through the root zone mantle and therefore became available for recharge of stream flow or ground water. On an adjacent area denuded of its cover, only 24 inches percolated through the root zone and an equal amount left the area as overland flow. The following year when precipitation was only 25 inches, 8 inches percolated through the soil of the forest and none ran off the surface. About 7 inches percolated through the soil of the cut-over stand and 3.2 inches ran off the surface. Thus in both years more water became available to streams and ground water from the forested land because loss of water from the study area by overland flow was prevented.

In some parts of the country flood control may be an important objective of management. Any water that can be stored in the forest during times of high precipitation will lower flood peaks. For example, consider conditions on the Truckee River watershed in Nevada and California which produced devastating flood discharges on November 20 and 21, 1950. Rainfall in September, October, and November was about three times normal. In its present condition the watershed could neither store nor slow the release of sufficient rainfall to prevent a record peak discharge that caused several million dollars damage to roads, water supply facilities, and business property in and around Reno in only a few hours. Nor could the pristine forest have prevented this flood. There can be little doubt, however, that preservation of only a reasonable part of the pristine forest, that is, some of the trees, litter, duff, and top soil that has been destroyed in the past 80 years by uncontrolled fire, and destructive log-

ging and grazing, would have provided sufficient additional water storage capacity on forested lands to have reduced considerably the high peak discharge that did much of the damage.

An example of how increasing the water storage capacity in the soil may reduce floods is provided by Bromfield's Malabar Farm in southern Ohio (*1*). Bromfield says, "When we first took over the fields at Malabar as much as 80 percent or more of the water that fell during a sudden cloudburst or even a long, heavy rain ran off the farm within 24 hours." He attributed this largely to removal of virgin deep-rooted hardwood forests that once occupied the deep glacial soils followed by "130 years of farming only 8 or 9 inches deep," that produced a plow pan almost impervious to water.

Using deep tillage tools and commercial fertilizers, deep-rooted alfalfa, brome grass and ladino clover have been established on these lands. "Today," writes Bromfield, "we keep over 95 percent of the rainfall where it falls to sink into the ground to feed our streams." He calls this "farming 3 to 20 feet down." It is entirely conceivable that this striking change in the hydrology of the land has been brought about by the deep-rooted plants that do two important things in flood control. First, deep root systems promote infiltration of water into the soil during periods of high rainfall. Secondly, they pump large quantities of water out of the soil by transpiration thus creating a like storage capacity in the soil for potential floodwater. The surface vegetation slows water movement giving it time to percolate into the soil. Furthermore, each time field capacity is reached by penetration of rainfall into the soil, water may pass on through to ground water and streams. These deep-rooted farm crops are doubtless controlling water on the land as forests did before they were cut.

That the seasonal distribution of water can be materially altered by forestry practices is apparent from available data. It cannot be emphasized too much, however, that accelerated soil erosion and resulting sedimentation must be prevented and therefore removal of trees from stream channels and slopes must be carefully appraised from this point of view.

Water Quality

As used here, water quality refers to the extent to which water is free of polluting elements that render it unfit for domestic and industrial uses or of sediment that may be deposited downstream. A cutting may cause little change in the composition and density of the stand but the roads for taking out the timber may have far reaching effects. Large quantities of dirt may be dumped directly into the streams, unstable cuts and fills made, and large areas of impervious surface created. Only a comparatively small area of such disturbance is sufficient to muddy runoff water. For example, during the Columbia River flood of 1948, it was observed that the runoff from logging roads and trails on a logging chance one square mile in area changed the North Fork of the Clearwater River from a slightly turbid, to a dirty muddy stream.

On the Coweeta Experimental Forest, a 200-acre watershed was logged by practices commonly used in the Southern Appalachians. Eventually 2.3 miles of truck road were bulldozed into the watershed to finish the logging job. Turbidity of the water from the logged area averaged 93 parts per million as compared with 4 p.p.m. for the stream on an adjacent undisturbed area. During storms, the water turbidity on the logged area reached a maximum of 7,000 p.p.m. as compared with 80 p.p.m. for the check area. Repeated measurements of road cross sections showed a loss of soil from the road of 1 cubic yard per lineal yard—a total of 6,850 cubic yards. From these figures, it is easy to see why this one logging job was sufficient to muddy the water from the 4,000-acre watershed to which it is only a minor tributary. Flash runoff from the roads has also caused higher flood peaks. Although the logged area is still forest covered and will produce another crop of timber, its water quality and sediment production are more typical of poorly farmed steep land than of forest.

Even the most careful logging operations greatly disturbed the soil. For example, under actual logging operations on a national forest in the Northern Rocky Mountains where the road and trail layout was carefully designed, the minimum area occupied by roads was about 8 percent for jammer and 10 percent for "cat" logging. Fortunately, there is little mystery about the principles of erosion control on logging roads and there are examples of good jobs. Generally, however, the possible damage to downstream water users has not been realized. A number of common sense improvements will go a long way towards lessening the destructiveness of logging operations.

In the Northern Rocky Mountains it is believed this can be accomplished by adherence to the following practices: Keep road grades below 25 percent, with 10 percent the objective on erosive soils; outslope or drain all truck and "cat" roads; exclude roads from stream bottoms; log lightly in a streamside strip 200 to 400 feet wide along permanent streams; skid logs to roads outside streamside strips with horses or winch; keep slash out of streams; dam all skid trails at frequent intervals to prevent development of gullies.

The fact that logging is largely an engineering problem may explain why only minor attention has been given to its hydrologic effects by the forestry profession. Nevertheless, since it constitutes such an important part of the practice of forestry, foresters rather than engineers have been and will continue to be blamed for destructive logging whether they are responsible directly or not.

Plans for prevention of pollution and sedimentation should be an essential part of every logging operation, the cost of which should be a legitimate charge against the logging operation. At the present time large amounts of valuable timber are located on municipal watersheds. In many instances timber removed on a carefully designed basis would materially in-

crease water yield. Surely American ingenuity can find ways of logging these valuable forests without damage to the quality of the water they yield.

From these experiments and observations—and others—we know that the quantity and quality of water from forested lands can be changed by forestry practices. True, we don't know all the answers. Neither do we know everything about silviculture but we attempt to use what we do know while gaining additional knowledge from research and practice.

Similarly we should begin to put to work our present knowledge of the relation of forest land management to water supply while we are gaining further knowledge by research and observation.

The first 50 years of professional forestry in the United States lies behind us. The profession can be proud of its accomplishments during this period in the science of growth and harvesting of the timber crop but it has only just awakened to its responsibility for that other great forest resource—*water*. Actually some foresters ignore this multi-billion dollar forest resource.

The future is crowding us with its challenging problems in resource management. None of these is more important than the problem of sustaining a usable water supply. On forested lands timber production is so closely allied with the regulated yield of pure, clean, sediment-free water that the forestry profession must assume responsibility for water management as well as for timber management in order to discharge its obligation to society.

To do this three things are necessary: (1) The forestry profession must clearly recognize and assume responsibility for water management from forested lands. (2) The job of managing the water supply from forested lands must be integrated with forest management. (3) Forestry schools must give sufficient instruction in the hydrology of forested lands to prepare foresters to assume responsibility for water management as part of their jobs as forest managers.

Literature Cited

1. BROMFIELD, LOUIS. 1950. Out of the earth. Harper and Bros. New York.
2. CROFT, A. R. 1948. Water loss by stream surface evaporation and transpiration of riparian vegetation. Trans. Amer. Geophys. Union 29-(2):235-239.
3. ———— and L. V. MONNINGER. Evapo-transpiration and water available for stream flow from some aspen forest sites. Intermountain Forest and Range Experiment Station. (In manuscript.)
4. DUNFORD, E. G. and P. W. FLETCHER. 1947. Effect of removal of streambank vegetation upon water yield. Trans. Amer. Geophys. Union 28 (1):-105-110.
5. HOOVER, M. D. 1944. Effect of removal of forest vegetation upon water yields. Trans. Amer. Geophys. Union. Part VI:969-975.
6. KITTREDGE, J. 1944. Forest influences. Pp. 112-113. McGraw-Hill. New York.
7. ROWE, P. B. and E. A. COLMAN. 1950. Disposition of rainfall in two mountain areas of California. California Forest and Range Experiment Station. (In manuscript.)
8. WILM, H. G. and E. G. DUNFORD. 1948. Effect of timber cutting on water available for stream flow from a lodgepole pine forest. U.S. Dept. Agric. Tech. Bul. 968.

Pasture Firelanes

The inflammability of experimental pasture firelanes established at Tidewater Station in the North Carolina Coastal Plain in 1948 was tested and rated April 12 and 13, 1950, during a period of high fire hazard. Forest litter was dry and highly inflammable surrounding the lanes. The lanes had been grazed heavily the preceding season but cattle had been removed in February. Cool-season forage species were beginning to grow.

A hot flame from a kerosene flame-thrower was sprayed along the windward edge, or down the center of each plot, and the rate of spread and behavior of the fire were noted. Legumes gave better fire protection than grasses, but a mixture of grass and legume was better than either one alone. Ladino clover afforded best fire protection because it encouraged close grazing of the grasses associated with it and also because it was green during the fire season. Lespedeza and big trefoil ranked next among the legumes, and sub clover last. Of the grasses, tall fescue and rye grass ranked first for fire protection, closely followed by Dallisgrass. While redtop was outstanding for controlling weeds and maintaining a dense turf, it had a higher inflammability rating than the other species. Ladino clover with tall fescue was the top-ranking legume-grass mixture, although others may provide statisfactory protection.

From the standpoint of inflammability, in this test, there was no significant difference between flat lanes and those that had been crowned and ditched. But the crowned lanes were much more valuable as access roads in this flat, poorly drained area.

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Profits from Release of Loblolly and Shortleaf Pine Seedlings

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Cutting low-grade hardwoods to release suppressed loblolly and shortleaf pine reproduction is a sound investment. The cost of treatment is low enough to be repaid soon by added growth of the pines, which respond quickly.

THE TENDENCY for low-grade hardwoods to encroach on upland pine sites is a major obstacle to profitable timber management in the shortleaf - loblolly pine - hardwood type over much of the South.

In southern Arkansas, the most common upland hardwood species are sweetgum, southern red oak, blackgum, post oak, white oak, hickory, and blackjack oak. Except for an occasional tree, these hardwoods are usually so limbly and defective on upland pine sites that they have little or no market value. Pine reproduction that seeds in under a dense hardwood canopy is eventually crowded out. Barring prolonged drought in their first year, pine seedlings will survive about 3 to 7 years under a low hardwood overstory and 10 to 15 years or more under a high one. But they grow slowly and few get through the hardwood canopy to reach merchantable size.

In this region, 59 percent of the excellent upland pine sites (capable of growing 500 board feet of pine per acre per year) are now dominated by inferior hardwoods. Fortunately, much of the area where hardwoods are dominant has a pine seed source, and a large percentage of the stands have pine already present though badly suppressed by the hardwoods.

In 1939, a study was established on the Crossett Experimental Forest, at Crossett, Ark., to see how the suppressed pines respond to release, how much of the hardwood should be removed to produce a well-stocked pine stand, and if the costs of treatment are justified by the growth of the released pine.

Study Procedure

The 16-acre tract selected for the study was typical of much of the surrounding overcut pine land (Fig. 1). Scattered pine seed trees and advanced second-growth that averaged about 25 square feet of basal area per acre were present, but inferior hardwoods blanketed most of the area. There were nearly 300 hardwoods from 2 to 24 inches d.b.h. (about 80 percent of these were 2 through 4 inches d.b.h.) plus about 6,000 smaller hardwood trees and shrubs per acre. Under this low, dense hard-

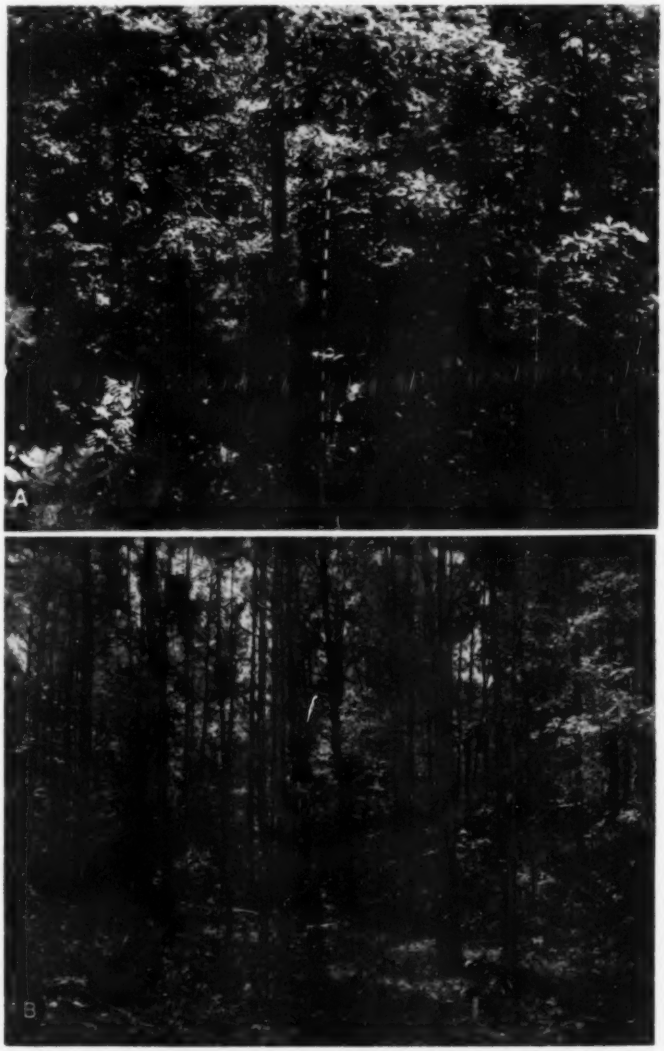

FIG. 1.—*A*, Typical part of stand in 1939; area was almost completely taken over by small, inferior hardwoods. *B*, Same view in 1949. Area was treated by removing hardwoods 5 feet tall and larger.

wood canopy were about 1,200 suppressed and overtopped pine seedlings per acre. Most of the pines were under 7 feet tall and were from the 1935 seed crop.

Three intensities of hardwood treatment were tested. Treatment 1 removed hardwoods 6 inches d.b.h. and larger, Treatment 2 removed hardwoods 2 inches d.b.h. and larger, and Treatment 3 removed hardwoods down to 5 feet tall. In all treatments, only those hardwoods (of the sizes noted) were treated whose crowns were overtopped or were within 2 feet of overtopping the terminal leader of a pine.

The study area was divided into 4 blocks, each containing 3 plots. Within blocks, treatments were assigned to plots at random. Despite the random assignment of treatments, original pine stocking (Table 1) was considerably greater on areas assigned to Treatment 3 than on those assigned to Treatment 2.

Immediately before cutting the hardwoods in 1939, a 100-percent inventory by species and diameter was made of all trees 2 inches d.b.h. and over, and a 5-percent inventory of all trees under 2 inches d.b.h. Whether or not the pines were overtopped was recorded both during the inventory and after the cutting. Remeasurements were made in 1943, 1946, and 1949.

In addition, 138 pine seedlings ranging from 0.2 to 7.1 feet high were measured and photographed at 2-year intervals throughout the study. Practically all of these seedlings were on areas that were given the most intensive hardwood treatment. While most seedlings received full release from hardwood, a few were left overtopped by hardwoods too small to cut according to the treatment specifications.

Treatment Costs

Hardwoods marked for removal were cut into chemical wood or girdled or felled. Since most landowners do not have a market for their small hardwoods, treatment costs were determined by assuming that trees 4 inches d.b.h. and larger were girdled and smaller ones were cut down. A wage rate of 75 cents per hour plus 21 cents per hour for overhead and supervision has been used in the computations in order to approximate present-day costs. The 1939 labor rates were actually only one-third of these.

At present-day labor rates, the treatment costs averaged 53 cents per acre for Treatment 1, $1.84 for treatment 2, and $2.43 for Treatment 3. In Treatment 1, 15 hardwoods per acre were cut or girdled; the average d.b.h. was 8.6 inches. Treatment 2 removed 136 trees averaging 4.7 inches d.b.h.; and Treatment 3 removed 432 trees averaging 3.0 inches d.b.h. The cost even of the most intensive treatment is considerably less than current planting costs in this region.

Table 1.—Stand Development by Treatments, from 1939 to 1949

D.b.h. (inches)	1939 After release	1949 Before thinning	1939 to 1949 Increase or decrease
	Number of pine per acre		
Treatment 1—Hardwoods 6 Inches D.B.H. and Larger Removed			
0—1.5	1,381	1,190	—191
2	9	84	75
3	15	41	26
4	12	25	13
5	13	17	4
6	8	12	4
7+	39	75	36
Treatment 2—Hardwoods 2 Inches D.B.H. and Larger Removed			
0—1.5	1,185	814	—371
2	17	120	103
3	13	84	71
4	9	51	42
5	11	37	26
6	7	21	14
7+	34	74	40
Treatment 3—Hardwoods 5 Feet Tall and Over Removed			
0—1.5	1,535	852	—683
2	28	140	112
3	21	99	78
4	15	64	49
5	15	43	28
6	13	29	16
7+	33	78	45

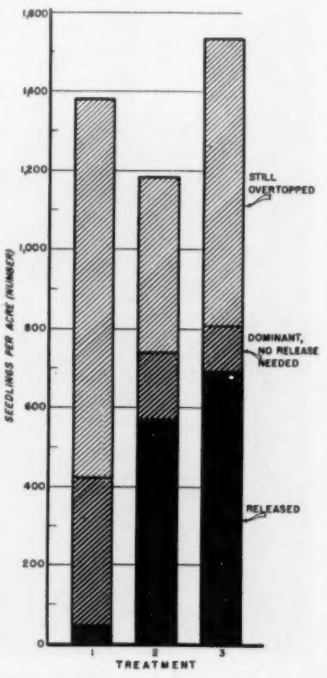

Fig. 2.—Status of pine reproduction 1 inch d.b.h. and smaller, immediately after 1939 release cutting.

Development of Released Pines

In all treatments, a few pines 2 inches d.b.h. and larger were released, but smaller trees benefited most. Treatment 1 was inadequate; it released only 47 seedlings per acre, less than 5 percent of the overtopped seedlings. Treatments 2 and 3 released 571 and 695 seedlings respectively (Fig. 2).

All plots had some dominant seedlings that did not require release. These were most numerous in Treatment 1. Conversely, in all treatments substantial numbers of seedlings were still overtopped after the hardwoods were removed. The data did not differentiate between overtopping by hardwood and by pine, but the high proportion of unreleased pine seedlings in Treatments 2 and 3 can be attributed largely to overtopping by pine seed trees and advanced second growth.

Growth and development of released pine seedlings during the 10-year study period has been excellent on areas given Treatments 2 and 3, but poor in Treatment 1 (Table 1). Treatment 1 brought about an increase of 122 pine seedlings per acre in the 2-inch through 6-inch d.b.h. classes, as against increases of 256 and 283 trees in Treatments 2 and 3. Increases in the number of pines larger than 6 inches d.b.h. were probably due to

normal growth that would have taken place without any hardwood treatment. Moreover, in Treatment 1, there has been an increase of only 21 trees per acre in the present merchantable-size classes that benefited from release (4 to 6 inches), while in both of the heavier treatments the increase of pine in these sizes has been 82 and 93 trees. The slightly better stocking in Treatment 3 than in Treatment 2 is probably due mainly to the 30 percent greater original stocking of seedlings plus the fact that more seedlings were released here.

Under Treatments 2 and 3, good stands of pine developed so rapidly that a thinning seemed necessary in 1949. Although an operable cut could not be made, the stands in Treatment 1 were also thinned, to compare returns with those from other treatments. The volumes cut in the thinning and stumpage returns are given in Table 2. The table includes only the volume of those trees estimated to have been 1 inch d.b.h. or smaller in 1939—that is, the trees primarily affected by the release.

The returns from this thinning exceeded the treatment costs by 81 cents per acre for Treatment 3 and $1.18 per acre for Treatment 2. Treatment 1 showed a loss of 15 cents per acre. If interest at 3 percent compounded were figured as a cost on the investment in each treatment the returns would be reduced to 03 cents, 55 cents, and a loss of 33 cents, respectively.

TABLE 2.—STUMPAGE RETURNS PER ACRE FROM THE FIRST THINNING OF RELEASED SEEDLINGS

Item	Treatment 1	Treatment 2	Treatment 3
Cost of treating hardwoods at 1949 wage rates	$0.53	$1.84	$2.43
Cord volume cut in 1949 thinning	0.19	1.51	1.62
Stumpage returns from thinning at $2.00 per cord	0.38	3.02	3.24
Returns from thinning less treatment cost	—0.15	1.18	0.81

Most landowners pay the cost of hardwood removal out of current returns, often from the same tract that is being treated. Hence they do not charge interest on the money invested in treatment. If interest is charged, however, it should be noted that the returns from this first thinning do not by any means represent the full benefit or value of removing the hardwoods. Of the stand which developed after removal of the hardwoods, only the poorer pines have been cut in this first thinning. The better and more vigorous trees are left for further growth and future cutting.

Observations on Staked Seedlings

Periodic photographs and measurements of the staked seedlings show that suppressed pines respond almost immediately to the removal of overtopping hardwoods (Fig. 3). In this study, the seedlings started vigorous height growth within a year after release and kept ahead of the hardwood sprouts so well that only two of

FIG. 3.—*A*, Suppressed loblolly pine seedling 2.3 feet high in April 1949, six months after the hardwoods 6 inches d.b.h. and larger were removed. Sparse, droopy foliage is typical of a seriously suppressed seedling that will die in a few years unless given release. *B*, By May 1943, the seedling was 10.3 feet tall and fully recovered from suppression. *C*, In July 1949, the suppressed seedling of 10 years ago was 3.6 inches d.b.h. and 27 feet tall.

the surviving seedlings had been resuppressed by sprouts by 1943.

At the time of release, 83 of the 138 staked seedlings were 0.2 foot to 3.0 feet tall, and 55 were over 3 feet tall. Nine of the smaller and 3 of the larger ones were still overtopped by hardwoods immediately after treatment. Fifty-one of the staked seedlings—5 large ones and 46 small ones—died between 1939 and 1949. Of the 74 small seedlings that had been released or that were in the open in 1939, 38 were dead by 1949. Of the 9 small seedlings that were still overtopped in 1939, only one survived.

As nearly as can be determined from the records, 21 seedlings died from suppression by hardwoods, 13 from suppression by pine, 7 from suppression by pine and hardwood combined, and 10 from ice damage and insects. Twelve seedlings, all under 3.5 feet tall in 1939, are now overtopped by hardwoods and badly suppressed. The heavy mortality in the smaller size classes, particularly from hardwood suppression, indicates the possible need for two release treatments when the majority of the pines to be released are under 3 feet tall.

The bulk of the resuppression problem came from understory hardwoods that were released along with the pine. When release work is being done, therefore, hardwoods likely to overtop pine when both are released should be removed.

Discussion

In this study the removal of hardwoods 6 inches d.b.h. and over did not release enough seedlings to justify the treatment. Since only 47 seedlings per acre were released, the major share of the ingrowth into the 2- to 6-inch diameter classes on this area probably came from the 374 seedlings per acre that were dominant before release. But even if all the seedling growth is attributed to the treatment, a more intensive hardwood removal is warranted by the greater returns.

Because of greater original stocking of seedlings in Treatment 3 and small differences in stand growth and development, it is difficult to judge which of the two intensive treatments was more profitable. However, since the results are so similar, it does not seem necessary to remove hardwoods down to 5 feet in height in such stands.

Where the bulk of the hardwoods are small (as in this study) and there are 500 or more well-distributed seedlings under the hardwood canopy, the most practical treatment seems to be to remove all hardwoods down to 2 or 3 inches d.b.h. plus smaller ones overtopping pine where pine is needed. It is very important that hardwoods not be cut or girdled unless there is adequate pine reproduction beneath them. Otherwise, sprouting may cause a greater and more expensive problem than before. Where adequate reproduction is lacking, hardwoods below 10 inches d.b.h., if treated at all, should be poisoned to reduce sprouting.

Results in this study are not unusual or better than most landowners in this region can expect, because many areas have two or three times as many overtopped pine seedlings per acre as were present on the study plots.

Cultivating Boosts Fusiform Rust Infection

Where hazard from southern fusiform rust is high, the increase in growth gained by cultivating and fertilizing a young slash pine plantation is offset by an increase in rust infection.

Slash and loblolly pine seedlings were planted on an old field in central Alabama in January 1945. In the spring of that year, two plots of each species were cultivated and fertilized. One plot of each species was left untreated as a check.

Four years after planting, the trees in the cultivated and fertilized plots averaged 9.6 feet tall, while those on the check plots were 7.5 feet high. Survival at that time was 71 percent on the cultivated and fertilized plots and 80 percent on check plots.

No rust cankers were found in June 1946, but percentages of trees with trunk or branch cankers increased sharply from June 1947 to March 1950. In the check plots, cankered loblolly jumped from 2 percent to 30 percent, and cankered slash from 6 percent to 43 percent. In the cultivated and fertilized plots, cankered loblolly jumped from 2 percent to 32 percent, and cankered slash from 11 percent to 67 percent. Thus the percentages of cankered trees were about the same for loblolly on both the check and the treated plots, but were considerably greater for slash on the treated plots. These findings substantiate results of a previous study in slash pine in Alabama.

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Stand Density and the Development of Young Jack Pine

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WHAT EFFECT does stand density have upon the development of young jack pine stands? It is known in a general way that overdense stands result in spindly trees and early mortality from competition, and that marked understocking results in heavy branching and poor form. However, there is little exact information as to the actual development of young stands established at known densities. Yet such information is of importance for handling both natural and planted stands. For this reason, in the spring of 1941 the Lake States Forest Experiment Station established a plantation on the Manistee National Forest near Wellston, Mich., in which jack pine was planted at five different spacings. Results at the end of nine growing seasons are reported here.

Past Findings

In Vermont, jack pine showed these differences 8 years after planting (or at an age of 10 years from seed) at spacings of 2 by 2, 4 by 4, 6 by 6, and 8 by 8 feet: diameter growth was retarded with denser spacings; height growth was least in the denser planting, but variable at other spacings; at wider spacings larger tracheids were produced; at denser spacings the lateral roots were forced to grow down and become thick, stubby, and much branched; the amount of dry matter per tree increased in direct ratio with wider spacing; and the amount of soluble ash per tree also increased with wider spacing.[2]

In northeastern Minnesota a jack pine stand of about 13,000 seedlings per acre, established by direct seeding, was thinned when 5 years old to spacings of 4 by 4, 6 by 6, and 8 by 8 feet. Five years later, diameters had increased and resistance to snow damage had been improved with the degree of thinning. A part of the same stand was thinned when 10 years old to spacings of 4 by 4 and 6 by 6 feet, and on a crop-tree basis. Heavy, wet snow storms the following year damaged the thinned plots more than the unthinned checks.[3] Mechanical thinning of over-dense stands was tested in two localities in Wisconsin.[3]

The Experimental Plantation

In the spring of 1941, a 10-acre plot was established near the Wellston Guard Station on the Manistee National Forest. Jack pine 1-0 stock of local seed origin was slit-planted in scalps at five spacings, 1½ by 1½, 3 by 3, 5 by 5, 7 by 7, and 9 by 9 feet. Twenty-five 0.4-acre subplots were arranged in a Latin square. The level planting site was on Grayling sand. A scattered stand of small scrubby mixed oaks made up the tree cover; it was cut to facilitate planting. There were scattered clumps of Jerseytea ceanothus, prairie willow, and sweetfern. The predominant ground cover was made up of grasses and sedges of several species.

Survival at the end of the first growing season averaged 77 percent for all spacings combined. All fail spots were replanted in the late fall, with 2-0 jack pine. Examination the second growing season showed such low losses that no further replants were made.

Effects of Spacing

Three years after planting, or at an age of 4 years from seed, the survival at different densities ranged from 90.2 to 92.6 percent, and average height from 1.8 to 2.0 feet (Table 1). These differences were too small to be significant, and there was no trend apparent which might be a result of stand density. The light mortality was caused by the red-headed pine sawfly, the white pine weevil, pine-oak gall rust, grasshoppers, and competition from sprout growth. Height growth was best in spots where brush piles had been burned.

At an age of 10 years, or 9 years after planting, survivals for the different spacings ranged from 87.4 to 91.2 percent, average heights from 8.4 to 8.7 feet, and average diameters breast high from 0.73 to 1.30 inches. Neither in survival nor average height were there any significant differences or trends chiefly attributable to different spacings. Average diameter at breast height, however, increased with greater spacing between trees, and this entire trend was highly significant according to an analysis of regression of spacing means. When comparing the average diameters for the individual spacings, the analysis showed that (1) the diameter of trees spaced 1½ by 1½ feet was smaller than those of trees at all wider spacings to a highly significant degree (1-percent level), (2) the diameter of the trees spaced 3 by 3 feet was significantly smaller (5-percent level) than that of trees spaced 9 by 9 feet, and (3) differences between the wider spacings were not yet large enough to be significant.

Qualitative observations also showed some differences in development of the trees planted at different spacings. All trees in all spacings have been attacked one or more times by the white pine weevil, but those in the closer spacings look better because they cannot spread out. Some patches of mortality from the shoestring fungus *Armillaria mellea* were noted, but they were not confined to any one spacing.

Trees spaced 1½ by 1½ feet apart were generally spindly (note high slenderness index in Table 1). There was considerable differentiation into crown classes; many

[1] Maintained by the Forest Service, U. S. Department of Agriculture, in cooperation with the University of Minnesota, St. Paul 1.

[2] Adams, W. R. Jr. Studies in tolerance of New England forest trees VIII. The effect of spacing in a jack pine plantation. Vermont Agric. Expt. Sta. Bul. 282. 1928.

[3] Roe, E. I. and J. H. Stoeckeler. Thinning over-dense jack pine seedling stands in the Lake States. Jour. Forestry 48:861-864. 1950.

Table 1.—Development of Jack Pine Planted at Different Spacings

Original stocking		At age[1] 4 years			At age[1] 10 years					
Between trees	Trees per acre	Survival	Height Average	Height Range	Survival	Height Average	Height Range	D.b.h. Average	D.b.h. Range	Slenderness index[2]
Feet	*Number*	*Percent*	*Feet*	*Feet*	*Percent*	*Feet*	*Feet*	*Inches*	*Inches*	
1½ by 1½	19,360	92.6	2.0	1.2-3.0	88.4	8.4	3-11	.73	0-1.3	11.5
3 by 3	4,840	92.2	1.9	1.0-3.6	88.0	8.8	5-11	1.08	.4-1.7	8.7
5 by 5	1,740	90.2	1.9	0.7-3.1	89.0	8.7	4-11	1.16	0-2.0	7.5
7 by 7	890	90.2	1.8	0.8-3.6	87.4	8.4	4-11	1.20	0-2.3	7.0
9 by 9	537	91.2	2.0	0.7-3.5	91.2	8.5	5-11	1.30	.3-2.5	6.5
Total	5,474	91.2	1.9	0.7-3.6	88.8	8.6	3-11	1.09	0-2.5	7.9

[1]Age from seed. Age from planting time is one year less.
[2]Ratio of average height to average diameter.

trees were becoming suppressed and probably will drop out in the next 5 to 10 years. This trend may be accentuated by the work of snowshoe hares which have caused a little mortality and considerable injury, chiefly to the smaller trees in the stand. Probably because of the thick cover afforded, hare damage was largely confined to this density. Girdling by hares has also been noted in stands of similar density in northern Wisconsin and Minnesota.[3 4] Ground cover is almost entirely shaded out, and the lower branches are dead on all but border trees. Despite weevilling, the main stem is straight on most trees. Snow breakage has caused a little mortality and some damage. Deer browsing and competition were other causes of injury.

Trees planted 3 feet apart were beginning to show some differentiation into crown classes. The lower limbs were starting to die but few were yet dead. There was a little damage (barked stems) from snowshoe hares. The main stem character was quite well preserved, despite weevilling.

In the plots planted at a 5 by 5-foot spacing, the branches were just beginning to interlace and none have yet begun to die. At this stage the 5 by 5-foot spacing looks best. There is an impression of good stocking without loss of growth or thrift from suppression.

The trees planted 7 feet apart have almost utilized their growing space, although only a few have branches touching each other. In the plots planted at a 9 by 9-foot spacing, all trees were still growing as individuals. Most of them have a rather sprawly appearance.

Intrepreting the Results

These results indicate the following conclusions for jack pine 10 years old (from seed) on medium poor sites in northwestern lower Michigan:

1. Stands of 17,000 trees per acre are too dense, have seriously reduced diameter growth, and will probably suffer considerable mortality from competition and snowshoe hare girdling (possibly also from snow breakage) in the next 5 to 10 years.

2. Even 4,300 trees per acre is somewhat too much stocking. Mortality from competition and snowshoe hares during the next 10 years may be considerable.

3. About 1,500 trees per acre looks like good stocking at this age.

4. The minimum acceptable stocking appears to be about 800 trees per acre; 500 trees per acre is definitely too few for satisfactory development.

Adams[2] in New England suggests that the first silvicultural thinning should be made about the time the lower branches start to die. Using that criterion, the 1½ by 1½-foot spacing should have been thinned several years ago, probably between 5 and 8 years of age from seed, and the 3 by 3-foot spacing ought to be thinned now. Field observations of the stands lend support to this recommendation.

Future observations on these plots will show whether the present interpretations of results are sound or how they should be modified. The plots were made large enough so that parts of each density could be thinned or given other cultural treatment. Such thinnings are planned and will permit comparison of stands established at lower densities with those which have been brought to comparable densities by thinnings. It will also point out the maximum initial density which will make it possible to defer thinnings without serious loss of growth until commercial products can be removed.

While jack pine plantations seldom will be planted closer than 5 by 5 feet, natural reproduction and direct seedings frequently approach or exceed the densest stocking tested. The results of this experiment should, therefore, be valuable in guiding the handling of either natural or artificial regeneration under similar soil and site conditions.

[4]Cox, W. T., Snowshoe hare useful in thinning forest stands. Jour. Forestry 36: 1107-1109. 1938.

A Comparison of the Climate in Four Ponderosa Pine Regions

G. A. Pearson[1]

ALTHOUGH GREAT DISTANCES separate various parts of the ponderosa pine zone, stands of the interior[2] range of ponderosa pine are usually found on sites of fairly similar climate. In this paper, a few climatic features in four widely separated regions are compared to bring out some of the basic differences and similarities. Mean maximum temperature, by months, and average monthly precipitation are used since both factors are closely related to the distribution of the species and to its silvical characteristics.[3]

Basis for Comparisons

Ponderosa pine regions used in the analysis include eastern California, eastern Oregon-Washington, the Black Hills of South Dakota, and northern Arizona. The climatic graphs presented in Figures 1 and 2 are averages from a few U. S. Weather Bureau stations[4] in each region, selected for long continuous records and representative locations within or adjacent to the ponderosa pine type. The precipitation data in Figure 2 should not be considered a reliable measure of average precipitation in each region. They are believed, however, to give a good picture of seasonal distribution which is regarded as even more significant.

Precipitation Differences Pronounced

A glance at Figures 1 and 2 makes it evident that temperature differences among the four regions are much less in both amount and seasonal distribution than the differences in precipitation.

Most conspicuous is the precipitation peak in Arizona during July and August. This peak is characteristic of the entire Southwest, including Arizona, New Mexico, and southern Colorado. It is present also in the Black Hills but is less pronounced there because of the relatively high precipitation in April, May, and June. Arizona has its lowest low in June, a feature which is shared in some years by New Mexico and less frequently by Colorado. Eastern California is almost as dry as Arizona in May and June, but eastern Oregon and Washington have noticeably more precipitation during these months.

April and May temperatures appear to be several degrees higher both in California and in the Northwest than in Arizona. A slightly better combination of heat and moisture in April and May

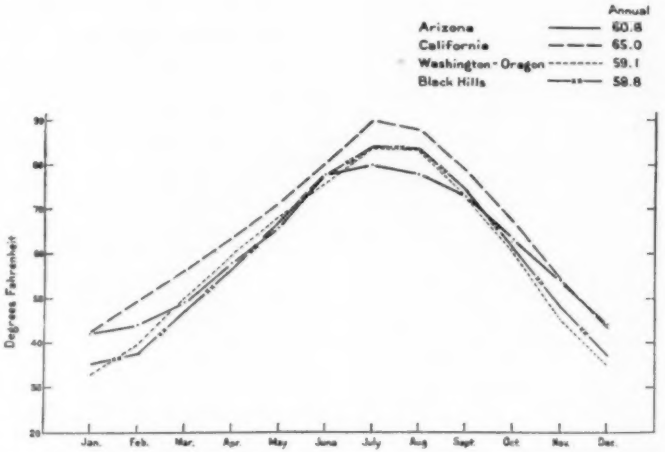

FIG. 1.—Monthly mean maximum temperature in the ponderosa pine type of four interior regions.

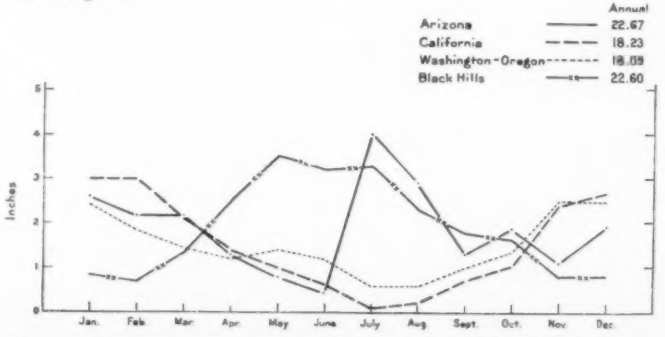

FIG. 2.—Monthly precipitation in the ponderosa pine type of four interior regions.

[1]Deceased. Formerly silviculturist, Southwestern Forest and Range Experiment Station. The material in this article was found among the author's unpublished writings following his death in January 1949, and revised for publication by George S. Meagher, forester, Southwestern Forest and Range Experiment Station.

[2]The term "interior" is used to distinguish the pure or almost pure stands of ponderosa pine from the mixed stands found on the west slopes of the Cascade-Sierra divide and at high elevations in other parts of the West.

[3]Pearson, G. A. Forest types in the Southwest as determined by climate and soil. U. S. Dept. Agr. Tech. Bul. 247. 1931.

[4]Weather stations used were: Chester, Fall River Mills, Hat Creek, Portola, Susanville, Westwood, and Montague in eastern California; Chiloquin, LaGrande, Ochoco R.S., Wallowa, and Joseph in eastern Oregon; Cle Elum, Colville, Deer Park, Leavenworth, Spokane, and Tieton Canyon in eastern Washington; Custer, Deadwood, and Hot Springs in South Dakota; and Flagstaff, Williams, and McNary in northern Arizona.

probably explains why pine germination in both of the first-named regions takes place in the spring while in Arizona it is usually deferred until July or August. The precipitation graph further makes it plain that mid-summer germination is impossible under ordinary conditions in either California or the Northwest, since July and August are in both regions the driest months of the year. In the Black Hills both temperature and precipitation are suitable for germination from May through August; this undoubtedly explains why pine reproduction is not a serious problem there, except on certain sites where grass competition is intense.

One characteristic which three of the regions (California, Northwest, and Southwest) have in common is high precipitation during the dormant period from November 1 to March 31. In the Black Hills a lower winter supply is supplemented by a greater quantity in May, June, and July. This departure of the Black Hills from the more general condition seems to favor regeneration at the expense of timber growth. It is undoubtedly the deep moisture reservoir accumulated during the dormant season of low temperature, low transpiration, and low evaporation that enables trees to grow through long drought periods in the Southwest, Northwest, and California.

California and Oregon stands run heavier in timber volume per acre and contain larger individual trees than are found in the most comparable Arizona and New Mexico stands; but mature trees of Arizona and New Mexico are much younger, seldom exceeding 300 years as compared with 400 to 500 years in California and the Northwest. Although there has been no systematic comparison of growth rates, site for site, the information available points to a slight margin in favor of Arizona.

The effectiveness of the Arizona and New Mexico summer rains in stimulating diameter growth of established trees may well be a subject of debate. Trees beyond the seedling stage have a root system extending several feet below the surface, while summer rains seldom penetrate over a foot and usually less than this depth. Although ponderosa pine has many feeding roots in the upper foot of soil, this layer is usually occupied by a much denser network of grass roots. In years of heavy summer rains, diameter growth is undoubtedly benefited; but when summer rains are below average or delayed until August, the benefit to diameter growth may be questioned. Light showers which stimulate herbaceous vegetation but do not penetrate below the upper 6 inches of soil may even result in a loss rather than a gain of moisture available to tree roots.

Other Ponderosa Pine Regions

Temperature and precipitation graphs for the ponderosa pine-sugar pine type of California are not included in Figures 1 and 2 because this is not regarded as a true ponderosa pine type. Monthly temperatures are somewhat higher, and winter and spring precipitation is more than twice as high as in the interior or "east side" ponderosa pine. Summer precipitation is about the same. Ponderosa pine attains its maximum development here in response to a combination of high precipitation and relatively high temperature; but the favorable moisture conditions place ponderosa pine at a disadvantage in competition with the more shade-enduring firs which are able to come in under the pine canopy and thus take possession when the pine is cut or dies from other causes. A similar condition occurs on the more moist sites of Oregon and Washington and to a less degree in the southern Rocky Mountains. Under these circumstances ponderosa pine ceases to be a climax species.

Baker and Korstian[5] have presented two additional precipitation graphs, one for the eastern Rocky Mountain region and one for the Central Plateau, the latter comprising parts of Colorado, Utah, Nevada, Wyoming, and Idaho. The eastern Rocky Mountain graph is characterized by low winter precipitation, which probably accounts for a generally inferior stand of ponderosa pine in that region. The Central Plateau graph is relatively high during the winter but sinks in May and does not rise appreciably until the following October. Ponderosa pine occurs only sporadically in this region, a condition which the authors explain by the absence of rainfall in sufficient quantity for regeneration in either spring or summer.

Black's Mountain and Fort Valley Compared

It is of interest to compare precipitation records and timber stands in the Black's Mountain Experimental Forest of eastern California with those of the Fort Valley Experimental Forest of northern Arizona. These records are of more than usual significance because both stations are located within ponderosa pine stands typical of their respective regions. For the period 1937 to 1945, the average annual precipitation at Black's Mountain was 18.43 inches as compared with 23.45 inches at Fort Valley (Table 1).

During the winter storage period, November through April, the total precipitation in the two

[5] Baker, Frederick S. and Clarence F. Korstian. Suitability of brush lands in the intermountain region for the growth of natural or planted western yellow pine forests. U. S. Dept. Agr. Tech. Bul. 256, 1931.

Table 1.—Comparison of Mean Monthly Precipitation at the Black's Mountain Experimental Forest, California, and at the Fort Valley Experimental Forest, Arizona, 1937 to 1945, Inclusive

Experimental forest	Inches												
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Black's Mountain	2.08	3.46	2.25	1.30	1.16	1.15	0.35	0.25	0.39	1.39	1.96	2.69	18.43
Fort Valley	2.69	2.84	2.83	1.84	0.49	0.64	1.68	2.94	2.15	1.70	0.92	2.73	23.45

forests is almost identical—Fort Valley 13.85 inches and Black's Mountain 13.74 inches. The greatest difference is during the growing season of May through September when Fort Valley receives 7.90 inches as compared with 3.30 at Black's Mountain. This advantage is partially offset by a margin of 1.18 inches at Black's Mountain in May and June.

Notwithstanding lower precipitation in the Black's Mountain forest, volume per acre runs about 18,000 board feet, or 5,000 board feet above that of the virgin stand at Fort Valley. A 6.5 percent admixture of white fir at Black's Mountain suggests that portions of it may be near the upper limits of the type, where either moisture or low temperature favors regeneration of white fir. The Fort Valley stand is pure ponderosa pine; firs make their appearance in this locality only on pronounced north slopes. Height of average dominants in the Black's Mountain forest is given as 114 feet at 300 years. At Fort Valley some dominants attain this height at a lower age, but average heights are lower because lightning is continually picking out the tallest trees.

Many Problems Common to All Regions

In many respects, both climate and ecology are essentially alike throughout the interior range of ponderosa pine. In all regions the climate can be described in general terms as cold and dry. The type is usually not more than one step removed from the desert and grows on soils too dry to support other tall-timber species. Moisture is the critical factor and a severe drought period retards growth and hinders regeneration. True, the drought season occurs at different times in different regions but its over-all effect is much the same.

Slow growth because of low precipitation or poor coordination between precipitation and temperature characterizes the interior type to the extent that saw timber meeting present standards calls for rotations of 200 to 300 years.

Natural reproduction is likewise a major problem in most of the type. In some localities, presence of advance reproduction tends temporarily to mask this situation but it is being found more and more that reproduction after cutting is slow and uncertain. Even the Black Hills, generally more favorable than other regions, has problem areas.

Another common problem is the deficiency of young growing stock above the reproduction stage. It is most severe in the heaviest stands because a preponderance of old trees has suppressed the younger age classes. Correction of this situation demands attention from Arizona to Oregon.

Despite similarities in climate and ecology, accepted forest-management practice differs markedly among the various ponderosa pine regions. Variation in markets, utilization standards, and economies explains part of the wide range in timber-growing practice, but distinct regional protection problems bear the major responsibility.

In many localities, enemies that kill or seriously damage trees overshadow the more basic factors of drought and competition. In California and the Northwest, large trees fall prey to bark beetles; in the Southwest, wind, lightning, and mistletoe are the common destroyers. These and other damaging agents, including fire, rodents, and disease, have introduced wide variations in local forest practice.

It is conceivable that as present old-growth forests are gradually replaced by thrifty immature stands, protection problems that now dictate timber-growing practice will assume secondary importance. If this trend materializes, foresters will become increasingly aware that the interior ponderosa pine type is a fairly uniform ecological unit subject to many of the same silvicultural principles.

Fomes Annosus on Eastern Redcedar in Two Piedmont Forests[1]

Walter W. Dwyer, Jr.

Forester, New England Forestry Foundation, formerly with the Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, in cooperation with the Southeastern Forest Experiment Station, Asheville, N. C.

A WIDE HOST range and destructive attack on numerous conifers have previously been ascribed to *Fomes annosus* (Fr.) Cke. This investigation concerns its occurrence on eastern redcedar, *Juniperus virginiana* L., in two Piedmont areas, the Duke Forest, at Durham, N. C. ,and the Calhoun Experimental Forest, at Union, S. C. The fungus produces a stringy white sapwood rot of the root and butt of redcedar.

At Duke, sporophores of *Fomes annosus* alone (Fig. 1) were taken to signify the presence of this fungus, and therefore incidence percentages there presumably are less than the true extent of the decay. At Union, sporophores were similarly tallied, and in addition, all cedars in the stands sampled were cut into at the ground line and examined for the very characteristic *F. annosus* rot. The incidence figures thus obtained were, therefore, relatively higher than those at Duke. Cedars of all sizes were tallied as encountered in chosen stands on 51 areas totaling over 400 acres and along 8 miles of bottomland. These areas were selected to represent a variety of forest types and soils.

FIG. 1.—Sporophore of *Fomes annosus* on a live eastern redcedar. Duke Forest, Durham, N. C.

Factors Related to Incidence

The survey at Duke related variation in incidence of *Fomes annosus* on eastern redcedar to differences in forest type, and in soil and site (*5*). This pathogen seemed to affect redcedar least in bottomland hardwood and upland hardwood types (Tables 1 and 2). Its incidence in pine types was greater. The 9.2 percent incidence of sporophore-bearing redcedars in the shortleaf pine type, for example, indicated a considerably higher prevalence of *F. annosus* on redcedar in that type, which was further indicated by a cedar mortality of 25 percent for the type. Pine types generally occupied long-abandoned agricultural land, and hardwood types represented more virgin soil. Suppression was not found to be a necessary factor in the infection of cedar by *F. annosus*.

Based on the presence of a typi-

TABLE 1.—INCIDENCE OF *Fomes annosus*, ON REDCEDAR IN DIFFERENT FOREST TYPES ON THE DUKE FOREST[1]

Forest type	Total cedars	Dead cedars		Cedars with conks[2]
	Number	*Number*	*Percent*	*Percent*
Bottomland hardwood	1,255	164	13.1	0.3
Upland hardwood	1,960	204	10.4	0.6
Pine hardwood	1,295	281	21.7	1.9
Loblolly pine	1,313	202	15.4	5.9
Shortleaf pine	1,880	468	24.9	9.2
Loblolly pine-shortleaf pine[3]	78	38	48.7	29.5

[1]As determined by presence of sporophores on the trees.
[2]Sporophores of *Fomes annosus* on both live and dead trees.
[3]One small area with dense hardwood understory.

TABLE 2.—INCIDENCE OF *Fomes annosus* ON REDCEDAR IN DIFFERENT STANDS CALHOUN EXPERIMENTAL FOREST

Stand	Total trees	Trees dead	Trees with *Fomes annosus* rot[1]	
			Living	Total
	Number	*Percent*	*Percent*	*Percent*
	Stands Predominantly Pine			
1	255	23.9	20.1	38.8
2	161	6.8	28.0	32.9
3	174	8.6	24.5	31.0
4	39	2.6	26.3	28.2
5	148	14.9	6.3	20.3
6	114	7.1	14.2	20.2
7	164	4.3	14.0	17.7
8	213	0.9	10.0	10.8
9	43	4.7	2.4	7.0
10	214	0.5	0.5	0.5
11	139	0	0	0
All pine	1,664	7.8	12.1	19.7
	Stands Predominantly Hardwood			
12	593	1.5	1.1	2.2
13	115	0	0.9	0.9
14[2]	46	8.7	7.1	13.0
All hardwood	754	1.7	1.3	2.7
	Field Stand of Young Cedars			
15	106	0	0	0
All	2,524	5.7	8.3	13.8

[1]Excluding cases of root rot not evident upon cutting into cedars at the ground line.
[2]Small bottomland hardwood area.

[1]Appreciation is extended to Dr. George H. Hepting, senior pathologist, U. S. Division of Forest Pathology, and to Dr. Frederick A. Wolf, Duke School of Forestry, for their kind assistance in this project. A more detailed report of this study is available at Duke University—a master's thesis by the author, "Factors related to the incidence of *Fomes annosus* on eastern redcedar in the Duke Forest."

eal rot or sporophores, the incidence of *Fomes annosus* on cedar in pine areas at Union was 20 percent. Cedars were not inspected for *F. annosus* rot at Duke. In pine stands at Duke, however, both the incidence of conks on cedar and the mortality rate of cedar were more than twice that at Union.

Some relation of incidence of *Fomes annosus* to soils became apparent on both areas. On the Duke Forest, cedars on acid and basic igneous soils, acid sedimentary soils, and basic Carolina slate soils were examined. The terms *acid* and *basic* are used to describe parent rock; all soils were in the acid range. Iredell, a basic igneous soil, and Orange, a basic Carolina slate soil, are both erosive and poorly drained. Yet they support more redcedar than any other soil on the Duke Forest (*1*), and of all the soils studied they had the lowest incidence of *F. annosus* on redcedar: 0.9 and 1.2 percent, respectively. Considering different soils in the same forest type, the loblolly pine type, for example, the incidence of conky redcedar was 4 percent on acid Whitestore soil and 10 percent on all the acid sedimentary soils. On basic Carolina slate soils it was 3 percent. On the poorly drained basic Orange soil the incidence was at its lowest for the loblolly pine type, 1 percent. However, on a poorly drained acid Worsham soil it was at its maximum of 18 percent. On an uneroded pine-hardwood area adjacent to the last, Worsham area, and also on Worsham soil, the incidence of *F. annosus* conks on cedar was only 1.5 percent.

Hardwood types generally had a low incidence of *Fomes annosus* on redcedar, regardless of soil type. These types were found on much less eroded and less disturbed soils than the pine types. The fertile, well-drained Congaree silt loam of bottomland areas also supported a low incidence of 0.3 percent. The incidence of this pathogen on redcedar thus varied with soil type as well as with forest type, being lowest on the more basic igneous and Carolina slate soils. On the latter soils at Duke redcedar mortality averaged 11 percent, while on soils derived from sedimentary acid rock the mortality was 21 percent.

The gullied, eroded Calhoun Experimental Forest at Union offers several important pathology problems. Among them are widespread littleleaf disease on shortleaf pine and a continuing mortality of redcedar. A survey of redcedar in 11 stands for sporophores or decay in the root collar region, has directly associated the redcedar losses with *Fomes annosus*.

Bottomlands and some north slopes excepted, the forested area of the Calhoun Forest is largely old-field pine, with various admixtures of hardwoods, and the pine stands tend to be open and thin, due in part to the littleleaf disease. Table 2 shows that the incidence of *Fomes annosus* was, on the average, much higher (19.7 percent) in pine types than in the hardwood stands (2.7 percent).

A U. S. Forest Service study of redcedar in the Ozarks suggested that heavy clay soils which had lost much topsoil might give very low survival of redcedar (*2*). Severe erosion existed over much of the area studied on the Calhoun Forest, and exposure of clay subsoil was common. Soils characterized as sandy loams had a lower incidence of the pathogen on redcedar than those listed as clay loams in the soil-type map for the forest.

As at Duke, gullied, eroded pine slopes on the Calhoun were associated with an increased incidence of the pathogen on redcedar. Laboratory cultures showed that *Fomes annosus* can develop an abundance of conidia on cedar, pine, and oak litters. Such conidial fruiting in the forest could help disseminate the fungus. A group-wise incidence of the pathogen on redcedar was often evident, suggesting the type of root-to-root transmission indicated for the fungus on Jeffrey and ponderosa pines in California (*6*).

Description of Infected Trees

Parched brown foliage characterized redcedars that had recently been killed by *Fomes annosus*. Living trees that were infected commonly but not invariably had an unthrifty appearance. The fungus is able to fruit long before the death of its host, and fruiting often occurred for several years after the death of a tree. Windthrown cedars usually showed evidence of *F. annosus* activity, since the fungus weakens the roots. Roots of small infected cedars frequently would break and the trees fall partly over when they were merely pushed from the side.

The stringy rot of *Fomes annosus* attacks only the sapwood of redcedar roots, root collars, and butts, extending upward in the trunk usually not more than 5 inches from the ground. Redcedar heartwood contains one or more substances toxic to this fungus. Even when supported by malt agar the fungus grew poorly over the surface of redcedar heartwood. Ground, water-washed heartwood supported very poor growth. Alcohol-washed ground heartwood supported better growth. Cedarwood oil is alcohol-soluble. Addition of cedarwood oil to the alcohol-washed heartwood or to sapwood inhibited the growth of *F. annosus*. Redcedar sapwood is reported to contain only 0.2 percent oil, while heartwood contains 3.5 percent (*4*). Apparently the cedarwood oil content of the heartwood protects it from decay by *F. annosus*.

Two brown cubical rots are sometimes found in redcedar heartwood; one caused by *Fomes subroseus*, and the other by *Daedalea juniperina*. These rots and their sporophores generally occur on the trunk well above the ground, whereas *Fomes annosus* conks almost invariably occur at the ground line, partly beneath the litter, or on the roots.

Incidence of Root Rot by Tree Diameter

Young redcedar reproduction usually was not seriously affected by *Fomes annosus*. Often healthy young cedars were coming up thickly beneath older cedars killed by the pathogen. In pine stands at Union, only 2.4 percent of the redcedars below 4.5 feet in height had

evident *F. annosus*, while 25 percent of those above that height were obviously infected. Table 3 shows the sharp increase in infection as the trees reached sapling size, the incidence continuing high until a diameter of 12 inches was attained. Such larger redcedars are uncommon on the Calhoun Forest, most presumably having been logged off.

At Union, 15 percent of the trees with root collar rot bore conks. Almost all dead redcedars cut into contained *Fomes annosus* rot on the Calhoun, and death could seldom be attributed to suppression. Sixty-one percent of all *F. annosus*-infected cedars in pine areas were living trees. The average diameter for infected trees was 3.5 inches. For live and for dead trees with conks the average diameter was 4 inches. At Duke 72 percent and at Union 50 percent of all conky trees were in the diameter range of 2 to 5 inches. Although this range included only 26 percent of all redcedars examined at Union, it contained half of the infected trees. Trees in the diameter range of 6 to 9 inches, comprising 3 percent of all cedars examined, had 10 percent of the infected trees.

Table 3 indicates that mortality on the Calhoun became heavy (14 percent) even in the 1.1- to 2.5-inch diameter class. Probably greater losses would have been evident in the larger sizes had not so many of the larger trees either been logged off, or died and decomposed, leaving only a few of the more resistant trees.

Table 3.—Relation of *Fomes annosus* on Eastern Redcedar to Tree Diameter in the Calhoun Experimental Forest[1]

Diameter at breast height	Total trees	Live trees		Dead trees		Trees with *Fomes annosus*	
Inches	*Number*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
0 (Ht. 3-24″)	242	241	99.6	1	0.4	2	0.8
0 (Ht. 25-54″)	249	246	98.8	3	1.2	10	4.0
0.1- 1.0	230	226	98.3	4	1.7	16	7.0
1.1- 2.5	571	493	86.3	78	13.7	160	28.0
2.6- 4.5	239	212	88.7	27	11.3	88	36.8
4.6- 6.5	179	161	89.9	18	10.1	47	26.3
6.6- 8.5	102	93	91.2	9	8.8	29	28.4
8.6-10.5	75	69	92.0	6	8.0	17	22.7
10.6-12.5	25	23	92.0	2	8.0	5	20.0
12.6 and up	15	15	100.0	0	0	1	6.7

[1]Pine stands only, including 263 larger cedars in a general survey.

The Build-up of Fomes annosus in Pine Stumps

At both Union and at Duke, *Fomes annosus* was well distributed over most pine areas surveyed. The fungus could frequently be seen fruiting on pine stumps at the Calhoun Forest. *F. annosus* has recently been found by coworkers on shortleaf pine stumps (Fig. 2) at Rock Hill, Walhalla, and Union, S. C., at points in Georgia, and at Asheville, N. C. Stumps of white pine and Virginia pine at Asheville have borne sporophores. Conks have also been collected on unthrifty shortleaf pine in the Duke Forest.

Fomes annosus has been reported in Europe as particularly severe on areas recently logged. Taking this observation together with the current findings and those of Hepting and Downs (*3*) on the build-up of *F. annosus* in old white pine stumps, we find that the pine stump becomes a major factor in the attack on redcedar by this fungus.

In a small stand of shortleaf pine logged selectively about 13 years previously near Asheville, N. C., 87 percent of the stumps in 1949 had the typical rot of *Fomes annosus*, and 72 percent of these 39 stumps bore sporophores, with the most abundant fruiting on larger stumps and in places given added protection by a low hardwood understory. Redcedars are not abundant in most of the region near Asheville, and none grew either in this area or in another area nearby where 12 of 15 shortleaf pine stumps had *F. annosus* rot, with 8 bearing conks.

In a 2-acre shortleaf pine stand on the Calhoun Forest 19 percent of 37 pine stumps 10 years old had *Fomes annosus* conks. Two young redcedars near one of these conky pine stumps had recently been killed by the pathogen, and one bore a sporophore of *F. annosus*. This pattern coincided with that reported for the fungus in many instances, and it agreed with the group patterns of incidence often seen on redcedar. *F. annosus* has been reported infrequently on

Fig. 2.—Abundant fruiting of *Fomes annosus* conks on a shortleaf pine stump. Asheville, N. C. Photo by E. Richard Toole.

hardwoods, and none was found on hardwoods in this survey.

Fomes annosus as a Forest Problem

An acre of abandoned field planted to eastern redcedar in northern Arkansas, with 6 x 6 foot spacing, produced 5,866 fence posts in 44 years (*2*). A 15-percent mortality was due largely to early failure of some of the wildlings used as planting stock. Although any strict comparison would be impossible, had these trees grown on the Calhoun Experimental Forest at Union, S. C., a much higher mortality would undoubtedly have occurred. Even with wider spacing, a considerable percentage of the trees would likely have succumbed to *Fomes annosus* before attaining an age of 44 years. Since one acre would not well support more than approximately 200 eastern redcedars approaching sawlog size, a satisfactory yield of sawlog and post-sized trees might be harvested even where *F. annosus* losses in plantations were high.

The group-wise attack on *Fomes annosus* often results in mortality exceeding the bounds of desirable thinning. The effects of thinning on the incidence of this fungus in redcedar plantations remains to be studied. Hepting and Downs (*3*) found that thinning increased the incidence of *F. annosus* in white pine plantings. Root crowding perhaps resulting from poor planting technique also was indicated to be a factor in that case. The high value of eastern redcedar makes possible a greater protective effort than many other species could profitably receive, if measures against *F. annosus* attack are discovered.

Summary

Examination of over 10,300 cedars on the Duke and Calhoun Forests showed that *Fomes annosus* is a common and sometimes serious pathogen on eastern redcedar in these areas. Trees below 1 inch in diameter largely escaped lethal attack. The average diameter for all trees affected was 4 inches. The disease tended to attack redcedar primarily in pine forest types, but it occurred also to varying degrees on redcedar in hardwood forests. There may be a relation between this distribution and the fact that *F. annosus* occurred commonly on dead pine roots and stumps. There seemed also to be a relation between *F. annosus* attack and the greater erosion in pine than in hardwood forests. More diseased trees were found on eroded and gullied pine slopes than in any other location. Certain soils derived from basic rocks seemed to support a lower incidence of *F. annosus* than soils from acid rocks. The fungus fruited on 15 percent of the cedars found to be attacked at Union. Root-to-root transmission and conidial sporulation on litter are other possible means of spread. Redcedar sapwood, only, is invaded by the fungus; heartwood contains a principle, presumably associated with cedarwood oil, that is toxic to *F. annosus*.

Redcedar approaching post and pole size in the Piedmont region, as exemplified by the two areas studied, can be expected to sustain losses exceeding 10 percent of the trees.

Literature Cited

1. APPLEQUIST, M. 1941. Stand composition of upland hardwood forests as related to soil type in the Duke Forest. Master's Thesis, Duke University.
2. AREND, J. L. 1946. Project analysis of eastern red cedar in the Ozarks. U. S. Forest Service.
3. HEPTING, G. H. and A. A. DOWNS. 1944. Root and butt rot in planted white pine at Biltmore, North Carolina. Jour. Forestry 42:119-123.
4. HUDDLE, H. B. 1936. Oil of Tennessee red cedars. Ind. Eng. Chem. 28: 18-21.
5. MILLER, J. K. 1943. *Fomes annosus* and red cedar. Jour. Forestry 41: 37-40.
6. OLSON, A. J. 1941. A root disease of Jeffrey and ponderosa pine reproduction. Phytopathology 31:1063-1077.

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JOURNAL OF FORESTRY
825 Mills Building
17th Street at Pennsylvania Avenue, N. W.
Washington 6, D. C.

Some Principles Governing the Growing of Redwood Crops[1]

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Once a redwood forest land owner has embarked on a program of tree farming he becomes interested in future crops. He will want to know what needs to be done on all his lands—virgin and cutover—to get the maximum future volume and quality of trees. It is the purpose of this paper to offer forest managers some principles and recommendations to guide them. These are based on about 30 years of observation, study, and experience in the redwood region.

THE GROWING OF REDWOOD timber crops is heavily influenced by what is being done, or has been done, on the lands dedicated to tree farming. The methods of cutting, logging, and slash disposal leave an almost indelible impression on the cutover land. Since the methods of cutting in the redwood region have changed significantly several times over the century, the cutover lands reflect their effects. By studying the growth on these cutover lands and reconstructing what happened to make it what it is, one can predict what might be expected if the methods are repeated. Fortunately, we have a wide variety of cutover lands, varying from those with almost no or very poor potential crop trees to those covered with dense 70 to 100-year-old second growth.

These cutover lands are the observant forester's best laboratory. Their variety could not be duplicated in controlled experiments except at inordinate cost and the results would not become available for from 50 to 100 years. To interpret these lands correctly the forester should have a sound understanding of tree physiology and ecology. And, the more he knows about his local climatology and soils, the better.

Since cutting practices have such a profound influence on the character of the subsequent crop, it is important to give first attention to the cutting of old growth to prevent the creation of cutover lands that may become future reforestation problem areas. When old growth cutting practices that are workable and reasonably sure to result in prompt natural reforestation are established, more attention can be given to methods of restoring full production on older inadequately reproducing cutover lands.

Four situations can be recognized: (1) Virgin old growth stands; (2) Second growth stands; (3) Brush fields dotted with sprout clumps; (4) Current clear cuttings.

Management Principles and Recommendations

Virgin old growth stands. Fortunately, most major operating companies still have sufficient acreages of old growth which, if cut properly, will go very far in setting up perpetual operations. The method of cutting old growth is determined by the nature of the forest.

There is a varying mixture of all age and size classes. This wide range of size classes, and the well-established fact that the size and quality of a tree fixes its profit or loss margin, indicates that some trees will return a profit and others will not. If marginal trees can be left standing, the second crop is already well established. Marginal-profit trees are generally immature trees. Although they may be 200 to 300 years old they have not reached merchantable size, but they generally possess considerable growth capacity.

Redwood can grow so slowly in a dense stand as to be almost dormant. Yet, if released from competition by partial cutting the rate of growth can accelerate markedly. Age seems to be less a factor than the condition of the individual tree. A growth rate increase from 30 rings to 6 rings per inch has been noted on a 1,000-year-old tree only partially freed from competition by a highway right-of-way cutting. Likewise suppression is not necessarily a deterrent to acceleration in growth rate after release. For example, a 12-inch tree, 160 years old, about 100 feet high and overtopped in a 300-foot-high stand containing about 165,000 board feet per acre, increased its growth rate from a fraction of one percent per year to an average of nearly 20 percent per year for the first 10 years subsequent to release.

Some redwood trees produce seed copiously every year; some apparently have never produced any seed. Since the marginal-profit trees are the shorter ones and are partially overtopped, they generally require a few years before they produce a good seed crop. Intermediate crown-class trees frequently produce good crops even before logging. Viability of redwood seed varies widely. An 8-foot tree, about 300 feet high, heavily loaded with cones when felled, proved on examination to have such poor seed that the cones were not worth collecting. Other trees, even as young as 20 years, may produce seed with more than 40 percent germination capacity.

Redwood seed is very small and its wings are not very effective for wide dispersal. However, it can be taken as a safe index that the seed will disperse in adequate quantities a distance equal to the height of the tree. It will disperse over greater distances, of course, but in inadequate amounts. This is an important factor when clear cutting must be practiced at times.

For germination, redwood seed requires a seed bed that will retain sufficient moisture during the dry weeks interspersing the wet season. Mineral soil provides the best seed bed, although germination can take place on moist logs, stumps, or duff.

Seedlings require sufficient moisture the first year to permit them to extend their roots below the

[1] Paper presented at a meeting of the Western Forestry & Conservation Assoc., San Francisco, Calif. Dec. 6, 1950.

depth of summer soil surface dessication.

Recognizing that the winter wet season may include one to three successive weeks of low relative humidity and that from June 10 to mid-October (sometimes later) there will be no rains, the dessicating influence must be mitigated. This can be best done by leaving a sufficient number of trees for shade and wind protection.

Major injury to a redwood tree, such as stripping off the branches by "side-swiping" during felling, or knocking off the basal bark during yarding, stimulates numerous dormant buds and results in a "feathery" trunk that cannot produce clear wood thereafter. Slash fires can do equal or more damage, even to killing the tree.

The number of trees to be left standing depends on the number of immature trees in the stand originally, as well as on original total density. The great diameter and height of some trees and their heavy crowns, make it difficult to save all the immature trees. Sometimes there are so few of the latter in heavy stands that it is impracticable to save any of them. Nevertheless, every immature tree felled is a loss to the owner whether or not its trunk is utilized. Each such tree represents a potentially doubled volume to be logged profitably in another 20 to 30 years. Collectively they would add to the life of the old growth timber operation. Consequently, as many of the immature trees should be left standing as is practicable to provide the maximum nucleus for an early profitable second cut of top grade timber. Once this first crop of residual trees is cut, the forest thereafter will have an entirely different character and will call for very different methods of management.

The residual stand will provide the seed for reforesting the gaps and for protection against soil dessication. The forest manager must not expect equal results from a heavy and from a light stand of residuals. The denser the stand the lower the percent of increase in growth rate, although the total volume growth will be large. In a stand of 10 to 15 trees per acre a growth rate of 5 percent per year on each tree can be expected subsequent to release. Reproduction will not develop as rapidly in a heavy as in a lighter stand. Nevertheless, from the standpoint of maximum advantage to the owner, one should sacrifice the possibility of new reproduction in favor of a heavier stand of residuals.

In the original stand are occasional defective trees of considerable size and volume which often cannot be profitably logged. Such trees should be left. They are likely to have positive value by the time the smaller residuals have reached merchantable value. In the meantime, their seed crop and shade should be welcome additions. Should there be a salvage operation contemporary with or to follow logging, it might be better to cut such defective trees at once.

Slash disposal, after logging old growth presents a largely unsolved problem. If left, it constitutes a real fire hazard. If burned, considerable damage may be done to the soil and to the residual stand. For the present it appears that slash should be left wherever it is lightly distributed, but burned wherever it is concentrated in heavy amounts. During the entire operation strong efforts should be made to prevent slash being piled against the residual trees. Slash fires should be limited in size to as small a unit as is practicable.

When Douglas-fir and white fir and other species are mixed with the redwood, they should be treated like the redwood as to immature trees. But white firs over 100 years old should be cut if a market is available for them. At approximately that age they will have reached a height that makes them subject to windthrow. It is desirable to have the Douglas-fir represented in future stands although the white fir should become quite valuable for fiber alone, as should also the hemlock.

Summarizing for the cutting of old growth: Leave as many of the immature trees of all species as is possible; protect them against logging and slash burning damage. Where slash must be burned, keep the fires small and under control within tractor trails. When some clear cutting must be practiced keep the openings small, under 40 acres if possible, and leave a heavy fringe or blocks of seed trees on the boundaries. The conversion of the miscellaneous ponderous old-growth stands to manageable stands is not simple. It requires the best the forester can give.

Second growth stands. There are several hundred thousand acres of excellent redwood second growth, ranging from about 50 years to nearly 100 years old. It is the result of application of the principles given above for the cutting of old growth stands. In some cases many seed trees were left and in others there was clear cutting in small blocks or in narrow strips. In all cases, logging progressed so slowly that there was always an abundant and near-by seed source and good protection from the uncut stands. All this second growth is of volunteer origin and it developed naturally and without any cultural operation. Consequently there has been a heavy volume loss through natural mortality. The trees, though straight, tall (up to 175 feet in 90 years) and of good form, have produced very little upper grade lumber. Dead redwood limbs are persistent. Although badly decayed and insect-infested, the dead stubs may remain for 50 years. (On old growth, dead branch stubs have been found to persist and to affect the quality of the lumber for 200 years.)

During World War II, a number of small mills cut second growth for military uses. As this was poorly manufactured and shipped green, the trade early in 1947 ceased accepting it. Since then very little has been cut. However, stands that will produce from 30,000 to over 75,000 board feet per acre are always likely again to be sought on a sellers' market. Where second growth is owned by a standard old-growth operator it should be preserved for a backlog to continue the plant after the old timber is depleted. In the meantime, investigations should be made into the feasibility of thinning these stands. If they are to

be thinned—practically all of them need thinning and would be improved thereby—the forester will have an important decision to make as to the form of the thinning. When only a pulpwood market exists, only those trees likely to be eliminated by natural mortality, and the branchy so-called "wolf trees" should be cut. In time, it should be possible to create markets for posts and small poles. These products will require a preservative treatment. If a saw log market again develops it may be found more advantageous in the long run to cut those dominant and codominant trees that have already reached a diameter too large to permit profitable accretion of upper grade lumber over the branch ends. It is assumed that in any thinning an effort will be made during felling to sweep off projecting stubs where it can be done without trunk injury. Such a thinning—from the top down—will result in a stand of smaller average diameter but of much greater capacity to produce volume and quality lumber by the time the owner's old growth has been cut. Intermediate and upper suppressed trees have a high capacity to recover from crowding and to make a growth rate approaching an annual average of 20 percent for 20 years following release.

Unless the trunks are severely damaged there is no danger of the development of branches from dormant buds. However, trees having a root-collar burl may develop basal sprouts.

Until more experience is gained it is preferable to thin 50-year-old and older stands in several cycles. It is not unlikely that a heavy thinning may result in wind damage. Trees above 50 years are very slender and have short crowns.

When no markets exist for thinnings, second growth redwood stands should be left alone.

Brush fields dotted with redwood sprout clumps. There are probably 200,000 to 250,000 acres of such cutover lands. They are the result of large-scale clearcutting, severe slash fires, and little or no reservation of seed trees. Some of these lands have been burned several times after logging in an effort to convert them to livestock range lands.

Only one very definite recommendation for current attention can be made for these lands: complete protection against fire. The brush is very effective in rebuilding the soil. To safeguard the accrued benefits from the hardwood leaf litter and to prevent new soil deterioration, fires must be excluded as vigorously as in a young growing stand. Furthermore, in many cases, there is a heavy growth of Douglas-fir, white fir, and redwood seedlings under the brush, often at the rate of more than 500 per acre. These seedlings are generally from the little seed that has blown in each year from great distances, from an occasional accidental seed tree, or from the edge of old growth. These seedlings are growing slowly but as the brush permits more light to enter as it grows older and taller, they can break through the brush canopy eventually and thereafter develop more quickly, shade out the brush, and create a promising stand of young timber. Some additional experimental work is needed in such stands, including experimental release of seedlings by thinning the brush canopy. The axe or brush hook and chemicals should be tried.

Where the brush harbors no seedlings a major operation is called for if a new crop of trees is to replace the brush. Artificial seeding has been tried experimentally and found to be successful in establishing seedlings under the brush. While the cost of seeding is reasonable, the seedlings are in the same position as those established naturally. To replace the brush would be a costly job. Perhaps a light controlled burn followed by seeding or planting, or bulldozed strips promptly planted, might be effective. Each company forester should give these brush fields constant study and experimentation so that he may be ready for a major reforestation job when his employer is ready to undertake one.

Current clear cuttings. Because tractors cannot be used advantageously on very steep slopes or in winter and high lead yarding must be resorted to, some clear cutting will continue to be practiced. If the openings are under about 40 acres and are surrounded by rows or blocks of seed trees, satisfactory natural reproduction can be expected in years of favorable germination and seedling-growth weather.

Under such conditions an effort should be made to leave spoke-like lines of seed trees beginning at a distance from the spar tree where the logging line trails begin to diverge sufficiently. "Tight-lining" from one tail tree to another should be avoided.

When the openings are too large or when natural seeding is doubtful, the forester in charge will have to resort to seeding or planting. Seeding has been tried experimentally and was found to be promising and certainly cheaper than planting.[2] It is possible that the planting mistakes made in the 1920's can be remedied. It is recommended that every effort be made to establish a new forest on current clear-cut areas as quickly after logging as is possible and before brush gains control.

Additional Recommendations

Fire protection. Over the entire history of redwood logging it was believed that periodic burning is good practice. This belief, is breaking down rapidly and changing to a policy of complete exclusion of fire except under rigid control for some slash disposal. To accelerate its acceptance requires energetic and intelligent education among woods employes and the general public. Fires have done vast damage to reproducing areas under 20 years old. Fortunately, the losses to date in the stands above 50 years have been small. Apparently the dense crown canopy of second growth and the absence of a heavy herbaceous ground cover are discouraging to the spread of wild fires.

Soil management. Redwood seedlings are more sensitive to soil dessication than are those of Douglas-fir. Also, they appear to be less

[2] Fritz, Emanuel. Spot-wise direct seeding for redwood. Jour. Forestry 48: pp. 334-338, May 1950.

able to develop a deep root system before the summer dry season. This is particularly true on naturally compacted soils that may become worse if travelled on extensively by tractors during wet weather. However, where the tractors have loosened only the top layers and have not ground in too much of the wood and bark debris, the seedling conditions appear to be improved.

The cutting of roads on steep slopes for tractor routes often creates poor reproduction conditions. Not only is a large area cleared for the roads, but the cuts have a tendency to slide in and the fills to slip out. The fills if stable, however, provide an excellent seed bed because the soil is so deeply loosened.

Slash burning is a factor in soil management. Very "hot" fires destroy practically all the organic matter so essential to moisture retention. Nevertheless, redwood seed does germinate well on such burned soils if kept moist. This is possible only under adequate shade.

Light slash litter shows evidence of being desirable. Consequently, light accumulations should not be burned. Mixed with it are many seeds and seedlings. New seedlings can become well established on such sites before root competition from other vegetation becomes serious.

The fire weeds—the native *Epilobium* and the two species of the exotic *Erechtites*—do not encroach on unburned cutover land effectively. On heavily cut burned lands they take almost full possession. Although they eventually thin out and during their possession aid in protecting the soil and nursing some seedlings, they are not wholly desirable. When dry they create dangerous flash fuels.

Other species, native and exotic. Where seeding or planting is resorted to, the native associates of redwood, particularly Douglas-fir and chinquapin, are desirable additions. Douglas-fir produces a more versatile wood than redwood under 100 years. The chinquapin, although not now used, produces a tree of such good form, quality, and growth rate, that it should not be overlooked. It produces a hardwood which, although difficult to season, would now be in considerable use were the natural trees more abundant in any one area.

In a region naturally poor in hardwoods, it seems desirable to continue and to expand experiments with such exoties as the California black walnut, blackwood acacia, yellow poplar, and others. It was a serious loss to redwood tree farming that the experimental plantings of species exotic to the redwood region, set out by Professor Woodbridge Metcalf in the 1920's, were destroyed by fire.

Personnel training. The year 1950 marks a turning point in local sentiment because of the setting up of a tree farm system. There still is a large job to be done to convert the local public and the woodsworkers to the possibility and desirability of managing redwood lands on a tree farm basis.

For a company to set up a tree farm policy is an important step. But so much depends on the men actually working in the woods that persistent and intelligent educational work must be done on them. Many fires can be prevented from running out of control, and many immature trees can be saved, free of damage, if the employe immediately concerned has an understanding of what tree farming means to him and his community, and if he has a sympathetic interest in the applications of the techniques involved.

These recommendations cannot be final. Now that redwood tree farming has become a fact and foresters are being employed to effectuate it, the actual doing of the job will quickly reveal possibilities for improvements. Fortunately, the men already so employed have good forestry foundations; they have an enthusiastic interest in their work and they should be given wide latitude by their employers to perfect their skills.

Observed Effects of Prescribed Burning on Perennial Grasses in the Ponderosa Pine Forests[1]

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PERENNIAL GRASSES as a forest floor cover appear historically associated with ponderosa pine throughout the greater portion of its range. We know this from testimony of the Indians and early whites and from appearance of extensive areas where such grasses still persist. Within the last forty to fifty years, however, because of ecological changes which are continuing to manifest themselves, grassy forest floors are becoming progressively less characteristic of the ponderosa pine region. Such changes apparently result from several causes, including overgrazing, attempted total exclusion of fire and by growth of dense stands of coniferous reproduction and various woody shrubs, which appear encouraged by overgrazing and movement of stock and by fire exclusion.

Because I have advocated testing use of prescribed fire to correct adverse conditions and have participated in its actual testing, I have been asked to describe its effect on perennial grasses (*1, 2, 3*). Although these observations on effects of prescribed burning are based on experience in the Pacific Northwest, I have also observed limited primitive areas of the southwestern ponderosa pine region, where periodic surface fires have continued to recent date and where overgrazing has not occurred.

Prescribed burning as a silvicultural and protection tool has been tested on a considerable area of ponderosa pine land on the Colville Indian Reservation of north central Washington. In the fall of 1942, this type of burning was employed in testing possibilities of thinning dense ponderosa pine reproduction stands. Subsequently, because of shortage of personnel and other emergencies resulting from the war, all efforts in such direction have been concentrated on application of the method in conjunction with reduction of logging slash hazard in selectively cut-over stands. This has involved spot burning of the slash and, later, burning of tractor piled slash. Burning is usually conducted in the fall, following the first rains, from prepared fire lines against the prevailing wind and down the slopes. In addition to firing slash, the burners set fire to all standing snags and to windfalls that usually lace the ground under each dense patch of reproduction. This is done with deliberate intention of removing such heavy fuel and of thinning the reproduction patches. These operations have already been described in considerable detail (*4, 5, 6*). It is appropriate for purposes of this paper, however, that certain features again be briefly described.

Topography, Soils, Precipitation, Timber Stands, and Ground Cover

As previously described the burning was conducted on several widely separated timber units of the reservation. Slopes varied from steep to very gentle, at elevations of from approximately 1,600 to 4,000 feet above sea level. Most of the reservation was heavily glaciated during the last ice age and the best forest stands now grow on glacial drift or moraine material, principally of granitic origin, although limited areas of underlying sedimentary or metamorphic rock are also encountered. Soil is principally a sandy loam derived partly from decomposition of granite boulders and rock outcrops and partly from deposition

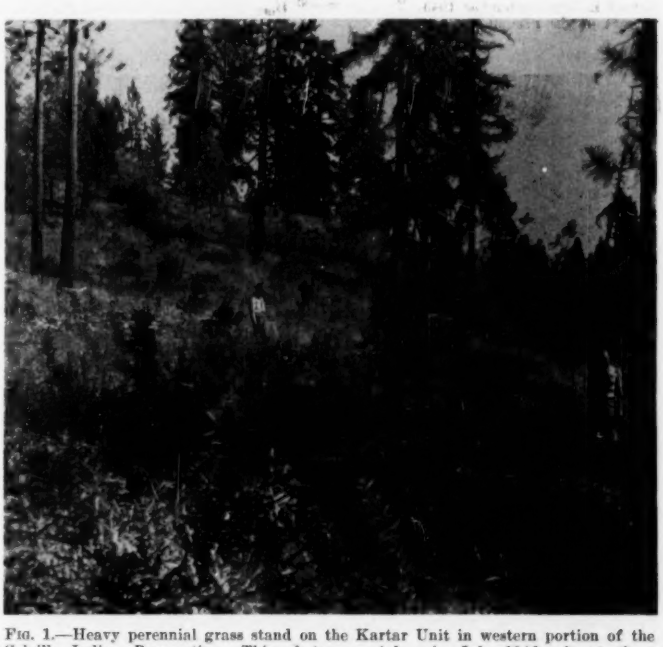

FIG. 1.—Heavy perennial grass stand on the Kartar Unit in western portion of the Colville Indian Reservation. This photo was taken in July 1946—almost three years after the area was burned during logging slash disposal operations of October 1943. Note numerous ponderosa pine saplings.

[1]This article represents the author's views only and is not to be regarded as an official expression of the attitude of the Indian Service on the subject discussed.

FIG. 2.—This photo taken in July 1947, illustrates the grassy forest floor under the ponderosa pine reserve stand of Twenty-Three Mile Valley, West Fork Unit, Colville Reservation. The cut in 1942 averaged 7 to 8 thousand board feet per acre. The reserve stand also averages 7 to 8 thousand board feet per acre. Slash was burned in late September 1943. It is estimated that the slash fire covered 85 to 90 percent of the ground surface.

FIG. 3.—Twenty-Three Mile Valley, five years after selective logging and four years after slash burning. Pinegrass predominates in the ground cover. Note ponderosa pine seedlings appearing above the grass and groups of more advanced Douglas-fir saplings that escaped the fire. Immediately before burning area was heavily grazed by sheep.

of wind-blown material, probably originating from the Big Bend region of central Washington. Annual precipitation in forested areas varies from an average of approximately 15 inches in the western portion of the reservation to 30 inches in the eastern portion. The western portion is more arid because of the continuous wall of the Cascade Range, across the Okanogan and Methow valleys to the west, which intercepts moisture-laden clouds from the Pacific. Eastward across the reservation higher and more rugged mountains are encountered and, as indicated, precipitation increases.

Above an elevation of approximately 2,500 to 3,000 feet Douglas-fir and western larch becomes associated with the ponderosa pine. Slope and aspect, as well as elevation, are of considerable influence on degree of mixture of these species in the stand. With respect to past fire history of the areas treated by prescribed burning, it was found that last previous wild fires over extensive portions had occurred during the years 1917, 1920, and 1926. Reproduction was almost uniformly abundant, especially in openings created by past insect attacks, except on some of the more heavily grassed areas. One limited area was encountered where it appeared that the last previous fire had occurred in 1905. This area, at a lower elevation, approximately 2,400 feet, was characterized by dense, stagnating stands of ponderosa pine reproduction and by a considerable volume of heavy fuel, principally snags and windfalls of trees deadened by insect attack.

At lower elevations, below approximately 2,000 to 3,000 feet, on areas adjacent to Indian and white ranches, perennial grasses have largely disappeared to be supplanted by cheat grass (*Bromus tectorum*). At higher elevations, however, including the greater portion of areas on which prescribed burning has been conducted, dense stands of perennial grasses still persist.

Pine grass (*Calamagrostis rubescens*) is the principal perennial

Fig. 4.—Twenty-Three Mile Valley, taken in July 1947, illustrating manner in which subsequent ponderosa pine reproduction is developing on all heavily burned spots caused by slash fire of September 1943. Note also that grasses are recapturing the clearing.

grass species. On the more open south slopes this grass gives way to a mixture of beardless wheat grass (*Agropyron inerme*), Idaho or blue bunch fescue (*Festuca idahoensis*), sheep fescue (*Festuca ovina*), June grass (*Koeleria cristata*), and occasionally to bluebunch wheatgrass (*Agropyron spicatum*). Mixed with the grasses are numerous weed species, including balsamroot (*Balsamorhiza sagittata*), white hawkweed (*Hieracium albiflorum*), gallardia (*Gallardia aristata*), geranium (*Geranium spp.*), five fingers (*Potentilla spp.*) heartleaf arnica (*Arnica cordifolia*), strawberry (*Fragaria spp.*), and lupine (*Lupinus spp.*) Associated shrubs include spiraea (*Spiraea spp.*), Oregon grape (*Berberis aquifolium*), common snowberry (*Symphoricarpos albus*), red soapbloom (*Ceanothus sanguineus*) and service berry (*Amelanchier spp.*). On limited areas there are encountered dense stands of snowbrush (*Ceanothus velutinus*).

In the eastern portion of the reservation on extensive slopes of the Hall Creek drainage, there were encountered dense patches of ninebark (*Opulaster spp.*) and ocean spray (*Sericotheca discolor*). On these slopes after effects of burning were watched with particular interest.

Effects of Burning on Perennial Grasses and Associated Shrub Species

Aside from spots where slash piles, windfalls, or snags caused exceedingly hot fires, the prescribed burning caused no apparent damage to the perennial grasses (Figs. 1, 2, and 3). The pinegrass developed countless thousands of seed stalks during growing seasons immediately subsequent to the burning. Mr. Frank B. Lenzie, until 1946 regional forester of the Indian Service in the Pacific Northwest, commented to the effect that fire frequently stimulates pinegrass in such a manner. Subsequent to burning, associated grasses also appeared of vigorous thrift.

On the previously mentioned slopes of the Hall Creek drainage the fire deadened most of the ninebark and ocean spray shrubs clear to the ground level. Subsequently they sprouted from roots, as it was suspected they would, The setback that these shrubs had received, however, obviously gave the grass at least temporary encouragement. I have never seen more luxuriant beardless wheatgrass and blue bunch wheatgrass than was observed on these slopes following the burning. It must be admitted that lack of grazing, even by Indian horses, may also have been of significance. It would appear that subsequent burns, repeated at intervals of several years, may continue to check the shrubs and to encourage the grass. Such burning, however, should be so conducted as not to affect adversely subsequent ponderosa pine reproduction, now becoming established, for timber growing potentialities are excellent on this site.

Even the cleared spots caused by the hot fires and the scarifying caused by the slash piling tractors appear damage of but temporary nature. It appears to me that it takes pinegrass but three or four years to recapture these spots. Also, other plants, such as fireweed (*Chamaenerion angustifolium*) speedily become established.

In the meantime it is hoped that seedlings of ponderosa pine will also become established on such spots as well as on the skid trails and landings caused by logging. This will enable development of more uniform stands of reproduc-

FIG. 5.—This photo, taken in August 1949, illustrates typical conditions in the Malay Gap Area of the San Carlos Indian Reservation, Arizona. Tree ring and fire scar data indicate that surface fires have covered this area once every 6 or 7 years. The most recent fire burned in May 1943. Mountain muhly is the principal component of the heavy grass stand.

FIG. 6.—The Malay Gap Area, where over-grazing has not occurred and where periodic fires have continued to recent date. This is one of the few remaining truly primitive areas of Arizona.

tion on the heavily grassed areas. Despite lack of good seed years and favorable spring moisture in proper combination, up to the year 1948, excellent subsequent ponderosa pine reproduction has become established on most of the higher elevations, on areas where reproduction of Douglas-fir normally becomes predominant with continued exclusion of fire (Fig. 4). On limited areas, however, Douglas-fir reproduction predominates on the burned spots.

Attempts at Reseeding to More Palatable Grass Species

Immediately following burning of tractor-piled slash in the fall of 1945, an area at approximately 3,300 feet elevation was seeded to mountain brome (*Bromus marginatus*) and to smooth brome (*Bromus inermis*). Excellent results were obtained on the burned spots, but very poor on the skid trails. Following the first snowfall of 6 to 8 inches on an immediately adjacent area the same fall, mountain brome was seeded on churned up earth and snow behind one of the tractors as it piled slash. Fairly good results were obtained from this seeding.

In the fall of 1946, on an area of approximately 3,500 feet elevation, where tractor-piled slash had been burned the previous spring, mountain brome seed was scattered over burned spots and skid trails. Then a band of sheep was grazed back and forth over the area for a period of several days. Mountain brome became well established on burned spots during the summer of 1947, but on skid trails there developed a dense stand of cheat grass.

In March 1947, a mixture of mountain brome and crested wheatgrass (*Agropyron cristatum*) was seeded at an elevation of approximately 2,500 feet. Behind the seeders two sections of spring-toothed harrow were dragged by means of a weapons carrier. Despite subsequent unfavorable mois-

ture conditions, examination of the area in July of the same year disclosed grass growing in every harrow tooth mark through the burned spots. Again, however, no plants were observed on the skid trails.

Only where seeding immediately followed the slash-piling tractor through the snow did we succeed in establishing planted grass on any but burned spots. This may indicate that considerable prior soil preparation is required on skid trails and landings.

Observations in Southwestern Ponderosa Pine Forests

As previously indicated I have observed limited primitive areas of the Southwest where periodic fires have continued to recent date and where overgrazing has not occurred. One of these is the Malay Gap portion of the Black River primitive area on the San Carlos Indian Reservation in Arizona. The most recent fire occurred in May, 1943. Approximate dates of previous fires were determined by cutting down a medium sized ponderosa pine with a basal fire scar or "cat face" and by counting growth rings and matching dates with the various interrupted healing efforts of the tree following recurrent fires. Previous fires occurred during the years 1935, 1919, 1910, 1898, 1893, 1889, 1885, 1879, 1876, 1868, 1856, 1851, and 1847.

Despite the frequency of such periodic surface fires the area is well stocked with excellent sapling and pole reproduction clumps of ponderosa pine in openings of the overstory of larger trees. Also the ground is covered with a dense grass stand of which mountain muhly (*Muhlenbergia montana*) is the principal species. (Figs. 5 and 6).

Conclusions

From limited observations I conclude that properly conducted prescribed burning does not seriously damage the perennial-grass forest-floor cover under ponderosa pine. In fact it appears beneficial through removal of competing vegetation and pine-needle mats. The same observation may be made with respect to grassy forest floors where periodic surface fires have continued.

Research to find methods of correcting adverse conditions now developing over extensive portions of the ponderosa pine region should be continued. Such research should include additional tests of prescribed burning.

I believe that perennial grasses should be maintained as a forest-floor cover under ponderosa pine. I also believe that through proper management developed by research, this grass forest-floor cover can be encouraged and maintained. In other words, I believe that we can grow both trees and grass on the same ground.

Literature Cited

1. Weaver, Harold. 1943. Fire as an ecological and silvicultural factor in the ponderosa pine region of the Pacific Slope. Jour. Forestry 41:7-15.
2. ———. 1947. Fire, nature's thinning agent in ponderosa pine stands. Jour. Forestry 45:437-444.
3. ———. 1950. Shoals and reefs in ponderosa pine silviculture. Jour. Forestry 48:21-22.
4. ———. 1946. Slash disposal on the Colville Indian Reservation. Jour. Forestry 44:81-88.
5. ———. 1947. Thinning pine stands by prescribed burning. West Coast Lumberman 74:111-114.
6. ———. 1947. Management problems in the ponderosa pine region. Northwest Science 21:160-163.

A New Method of Volume Regulation

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NUMEROUS METHODS have been devised for computing the allowable annual cut of forest properties that will lead to establishment of favorable conditions for sustained yield. Most of the methods employed are of European origin, and consist generally of the application of empirical formulas. Some of these old formulas yield satisfactory estimates of the allowable annual cut under specific arrangements of the growing stock with respect to the distribution of area by age classes, and to density of stocking. The simplest formula available is Von Mantel's, which yields a rough estimate of the annual cut if the age class distribution is approximately regular. Density of stocking may be at any level. Hundeshagen's formula furnishes a better estimate under the same conditions, but yield tables must be available for its application.

Most of the properties to be brought under management are radically irregular with respect to the distribution of area by age classes and to density of stocking. Under these conditions both Von Mantel's and Hundeshagen's formulas may lead to estimates that are far from correct. When the growing stock consists entirely of even-aged second growth stands, distinguishable by age, the Austrian formula will generally furnish good estimates. The most usual condition encountered in the Pacific Northwest at the present time is the property consisting of some old growth virgin timber, a relatively large area of young second growth, and perhaps some smaller representation of intermediate and mature age classes. The age of the stock classified as old growth virgin timber usually varies between 200 and 350 years of age. It is adding very little growth if any and in many instances it may be deteriorating in volume. It is very desirable to remove such stock as early as possible to permit re-establishment of growing stands, but in order to realize a continuous and sustained annual cut it is often necessary to make it last until the immature age classes have attained a reasonable cutting age. For this type of property Hanzlik's formula (*5*) has been widely used in this region.

Formula estimates of the annual cut have been used as the final allowable annual cutting volume. More recently the formula values have served merely as preliminary estimates to be tested by a detailed computation of cutting ages and total cutting time that would result from cutting at the estimated level. This computation procedure has been fully explained by Hanzlik (*5*) and the West Coast Forestry Procedures Committee (*8*) and is repeated in detail in subsequent pages. Following the age-time computation, the annual cut is revised to a higher or lower level in order to establish either the minimum cutting age or the total cutting time at a more reasonable point.

The Austrian and Hanzlik formulas are more or less empirical rules requiring an understanding of their underlying theories before they may be applied with confidence. The basic theories of both are rather involved and misapplications often result. It is the purpose of this paper to review the application of the two formulas, to present another more simple procedure of computing a preliminary estimate of the annual cut and to compare the results obtained by the various methods.

In order to demonstrate procedure of application, three separate cases have been chosen, all of which are very irregular with respect to the distribution of area by age classes. Each is representative of a Douglas-fir property in the Pacific Northwest consisting of even-aged stands to be regulated for sustained yield under a rotation of 100 years. An inventory of the property has been made in each case so as to provide a tabular summary of the distribution of area by age classes and the average density of the growing stock in each age class, or the volume of growing stock in each age class. Usually the density of stocking is obtained through basal area for the younger immature stands, while volumes are cruised in the older stands. In either case the one may be converted to the other by reference to normal yield tables. To simplify the procedures the tabular summary of the forest condition is expressed on a proportional basis, for a total area of R or 100 acres. Any property may be readily reduced to such a basis as demonstrated by Matthews (*6*).

Application of Formulas

Case A

This example is a property consisting entirely of second-growth even-aged stands having an average site quality of III, or a site index of 140 feet. The age class-area distribution, density of stocking, and growing stock volumes for trees 12 inches and over are as shown in Table 1. The distribution of the area by age classes is far from normal, there being too much area in the younger age classes and too little in the older. Some over-R-age stock is also present.

Because of the disproportionately small areas in the older age classes, there is much less volume on the property than would be present if there were a normal distribution of age classes. There is therefore a deficiency of growing stock due to the irregularity of the age class distribution. There also is irregularity due to the understocked conditions of the stands, the average density over-all and weighted by area, being 0.684 of normal density. For this type of property the Austrian formula generally provides a good estimate of the annual cut. In this particular case where irregularity occurs in both age class distribution and stocking, Chapman's (*1*)

TABLE 1.—SUMMARY OF AREAS AND GROWING STOCK CONDITIONS FOR CASE A, ON A PROPORTIONAL AREA BASIS

Age class (years)	Prop. area (acres)	Stocking ratio	Growing stock Volume M.B.M.
—10 to 0	15	Satisfactorily	—
0-10	25	stocked[1]	—
10-20	15		—
20-30	10	0.60	—
30-40	10	0.60	14.4
40-60	5	0.76	47.1
60-80	5	0.75	132.0
80-100	5	0.78	214.0
100-120	5	0.75	261.0
120-140	5	0.70	280.0
Total	100		948.5
Average (wtd.)		0.684	

[1] Stands in these younger age classes are either satisfactorily stocked at present or the ground will become adequately restocked within 10 years by reason of an adequate seed source and/or of guaranteed planting. It will be assumed that the stocking in these stands will eventually compare to that of the older stands.

application[1] of the formula must be used, which may be expressed as:

$$\text{A. C.} = \text{Ie} + \frac{\text{Ga} - \text{Ge}}{\text{R}}, \text{ wherein:}$$

A. C. is the Annual Cut in volume.

Ie is the empirical mean annual increment for the rotation contemplated and for the average density of stocking. In this particular case the stocking ratio is 0.684 and the normal yield[2] for Site Quality III Douglas-fir at age 100 is 62,800 board feet. Ie is therefore 0.684 x 62,800=42,800 board feet per 100 acres of property. This is also equivalent to the empirical yield of one acre of growing stock at 100 years of age.

Ga is the actual volume of growing stock as determined from the inventory. It amounts to 948.5 M board feet per 100 acres of property.

Ge is the volume of growing stock that would exist if there were a normal distribution of age classes, but with stocking as it is. It is obtained best by computing the normal growing stock from a normal yield table, and then multiplying this value by the ratio of stocking. Chapman (*4*) has called this, the "regulated empirical growing stock." The normal growing stock for Douglas-fir Site III under a rotation of 100 years is 2,083 M board feet per 100 acres, and Ge is therefore 2,083 M x 0.684=1,424.8 M board feet per 100 acres. By substitution then:

$$\text{A. C.} = 42.8\text{ M} + \frac{948.5\text{M} - 1{,}424.8\text{M}}{100}$$

$$= 42.8\text{M} - 4.8\text{ M} = 38.0\text{M}$$ board feet per 100 acres of property.

In this example there is less growing stock on the ground than there would be if the age class distribution were normal. The latter part of the formula after the plus sign, expresses the existing deficiency on an acre basis, and algebraically it results in a reduction of the annual cut from 42.8M —which would be correct if there were a normal distribution of age classes—to 38.0M board feet.

Under a system of volume regulation, the allowable annual cut is a volume which will permit R years of continuous operation at a uniform level. With a regular distribution of age classes, establishment of the allowable annual cutting volume also fixes the cutting age of the stands at R years. With an irregular distribution of age classes and a fixed cutting volume, the cutting age of the stands will vary as time proceeds, depending upon the character of the age class distribution. In the example given above, the cut would begin with the older stands of 120 to 140 years, but since there are relatively small areas in the older age classes, the cutting age will fall continuously until the stands now 10 to 20 years old are reached. And since there are relatively large areas in this and the lower age classes, the cutting age will then increase. Furthermore since the age class distribution is heavily overweighted with very young stands, the average cutting age will be much less than R years. This analysis leads to another more direct and simple means of getting a preliminary estimate of the annual cut. Since the latter is closely related to the age at which the stands are cut, it follows that if an estimate can be made of the average cutting age during the first rotation, the actual yield obtainable at that age should furnish a good estimate of the annual cut. The detailed procedure for Case A is as follows:

1. Compute the average weighted age of the growing stock, by multiplying the midpoint of each age class by the area of each, and then divide the sum of the products by the total area, thus:
(130 x 5) + (110 x 5) + (90 x 5) +(15 x 15)+(5 x 25)—(5 x 15) =3025 is the sum of the products, and dividing by 100 gives the average age of 30 years rounded to the nearest year.

2. Determine the average cutting age. If the age class distribution were normal the average age of the growing stock for a rotation of 100 years, would be 50 years. On this property the average age is only 30 years, a discrepancy of 20 years. This means that the average cutting age will be 100 minus 20 years, or 80 years.

3. Compute the average weighted stocking as before. It was found to be 0.684 of normal.

4. The estimated annual cut is then, 0.684 x 45.7M (the latter value being the normal yield at age 80, Site III) = 31.3M board feet per 100 acres of property.

The two methods employed have furnished two widely divergent estimates of the allowable annual cutting volume. Which is the better? To answer this question either one may be tested by determining the number of years of cutting each age class of growing stock will

[1] Some explanations of the application of this formula prescribe the use of the normal growing stock (Gn) where the regulated empirical growing stock (Ge) is used above. Chapman's application appears to be the most logical to the writer.

[2] The normal yields throughout this report are from U.S.D.A. Tech. Bull. No. 201, "The yield of Douglas-fir in the Pacific northwest," Table 4 p. 27 as recorded for trees 12 inches in diameter and larger.

provide, assuming that the cut will start in the oldest stands and proceed consecutively to the younger. The best estimate is that which comes nearest to providing a total of 100 years of operation, then a second revised estimate may be tested. To avoid unnecessary repetition of procedure, a revised estimate of 33M board feet is tested in Table 2, which is the final estimate of the annual cut on a gross volume basis.

The detailed procedure of making the cutting time test has been described by the West Coast Forestry Procedure Committee (*8*). The age classes and areas are set up in reverse of the previous order, and the length of cutting time provided by each age class is determined in sequence of age. In Table 2 the midpoints of the age classes are recorded rather than the class limits. The argument then proceeds as follows:

Age Class 130 years.—Since there are 5 acres out of the total R acres it should provide about 5 years of cutting time. As the cut proceeds, the average cutting age will increase to $130+\frac{5}{2}=132.5$ years, or say 133 years.

Normal yield at 133 years is 81,350 board feet.

Actual yield at 133 years is 0.684 x 81,350=55,500 board feet per acre.

Total volume on 5 acres is 5 x 55,500=277,500 board feet which will last at 33M per year, $\frac{277,500}{33M}=$ 8.4 years.

The first estimate that 5 acres would last 5 years was in error, as we found it would last for 8.4 years on the volume basis. A recomputation is therefore necessary.

Average cutting age will be more nearly $130+\frac{8.4}{2}=134$ years.

Normal yield at 134 years is 81,800 board feet.

Actual yield at 133 years is 0.684 x 81,800=55,800 board feet.

Total volume on 5 acres is 5 x 55,800=279,000 board feet, which will last $\frac{279,000}{33M}=8.5$ years.

Age Class 110 years. — Since there are 5 acres in this class it should last about the same time as the former class but somewhat less because the average cutting ages will decrease to some extent. Let us estimate therefore that it will last 8 years. Cutting has proceeded for 8.5 years in the first class.

Average cutting age is then $110+8.5+\frac{8}{2}=122$ years.

Normal yield at 122 years is 76,000 board feet.

Actual yield at 122 years is $0.684 \times 76,000 = 52,000$ board feet.

Total volume on 5 acres is $5 \times 52,000 = 260,000$ board feet, which will last $\frac{260,000}{33M}=7.9$ years.

And this requires no further adjustment.

Age Class 90 years.—Estimate of time 8 years.

Average cutting age 90 + 16.4 +4 = 110.

Normal yield at 110 years is 69,400 board feet.

Actual yield at 110 years is $0.684 \times 69,400 = 47,500$ board feet.

Total volume on 5 acres is $5 \times 47,500 = 237,500$ board feet which will last $\frac{237,500}{33M}=7.2$ years.

This requires no further adjustment.

Continuing through the remaining age classes one by one, results very close to those recorded in Table 2 should be obtained. Cutting at the rate of 33M board feet per year allows approximately 98 years of operation, slightly less than 100 years, but this is considered sufficient verification of the value tested.

If the values of 38M and 31.3M board feet as estimated by the Austrian and Hanzlik's formulas are tested in the same way the total cutting times prove to be approximately 48 and 121 years, respectively. It is thus evident that the Austrian formula has erred by about 5M board feet, and the method based on average cutting age by less than 2M board feet from the verified value of 33M board feet.

Another important point to consider in addition to the total cutting time permitted by a given annual cutting volume, is the minimum cutting age that will be reached as cutting operations proceed. By referring to Table 2 it is found that the minimum average is 70 years when the present 15-year age class is reached. If this minimum is considered too low to provide material of sufficient size for efficient utilization, or if, for silvicultural reasons it is deemed unsatisfactory, then it will be impossible to establish the annual cutting volume at this constant level for the whole rotation. In this event the annual cut would have to be set at a lower level so as to permit a longer cumulative cutting time in the older age classes. If 85 years were set as the minimum acceptable cutting age, then instead of cutting to the present 15-year age class in 50 years, it would be necessary to prolong the period to 70 years.

TABLE 2.—TEST OF AN ALLOWABLE ANNUAL CUTTING VOLUME OF 33M BOARD FEET PER 100 ACRES OF PROPERTY

Age class	Proportionate area	Average cutting age	Actual yield per acre M.B.M.	Total yield M.B.M.	Cutting time	
					Age class	Cumulative
130	5	134	55.5	279	8.5	8.5
110	5	122	52.0	260	7.9	16.4
90	5	110	47.5	237	7.2	23.6
70	5	97	41.2	206	6.2	29.8
50	5	82	32.3	161	4.9	34.7
35	10	73	26.2	262	7.9	42.6
25	10	71	24.7	247	7.5	50.1
15	15	70	24.0	360	10.9	61.0
5	25	76	28.3	707	21.4	82.4
—5	15	85	34.2	513	15.5	97.9
Total	100				97.9	

The temporary annual cutting volume on this plan may be determined roughly as $\frac{50 \times 33M}{70}$ = 23.6M, which will prove to be too low. The writer has found by trial and error that a volume chosen at two-thirds of the difference between the original value and the one just determined will prove to be nearly correct. This rule would place the next revised trial value at 26M board feet to establish the minimum cutting age at 85 years. At the end of the initial period of 70 years the property would sustain a higher annual cut in stands always older than the minimum of 85 years.

Case B

This example, as in Table 3, also is representative of a property consisting entirely of second-growth stands. The distribution of age classes again is very irregular, but the area allotments are greatly in favor of the older age classes. There is therefore a surplus of growing stock over that which would be present if there were a normal distribution of age classes.

For computation of the annual cut by Austrian formula, for a rotation of 100 years:

Ie = 0.641 × 62,800 = 40,200 board feet

Ge = 0.641 × 2,083,000 = 1,335,000 board feet and the A.C. $= 40{,}200 + \frac{2{,}471{,}000 - 1{,}335{,}000}{100}$

= 40,200 + 11,400 = 51,600 board feet

By the average weighted age procedure:

Actual average weighted age of stands = 70 years
Normal average weighted age = 50 years
Age advantage = 20 years
Average cutting age — 100 + 20 = 120 years
Normal yield at 120 years = 75,000 board feet
Annual cut — 0.641 × 75,000 = 48,000 board feet

A cutting-time test as was made for Case A, will show that an annual cut of 48,000 board feet will permit 101 years of continuous operation. This value is therefore a better estimate than the 51,600 board feet obtained by the Austrian formula, although in this case even the latter is a very good estimate. Since there is a better-than-normal age class distribution here the minimum cutting age is not important. Cutting ages always exceed R or 100 years.

TABLE 3. — SUMMARY OF AREAS AND GROWING STOCK CONDITIONS FOR CASE B ON A PROPORTIONAL AREA BASIS

Age class years	Proportionate area acres	Stocking ratio	Growing stock vol. M.B.M.
0-10	5 } Satisfactorily		
10-20	5 } stocked		
20-30	10	0.50	
30-40	8	0.66	12
40-60	17	0.53	112
60-80	15	0.65	342
80-100	10	0.72	396
100-120	15	0.68	709
120-140	15	0.75	900
Total	100		2,471
Average (wtd.)		0.641	

Case C

This case is typical of many properties in the Pacific Northwest. The area allotments for the age classes under 60 years are the same as in Case A, but instead of consisting entirely of second growth, there is some virgin old growth stock on which no further growth may be expected.

In a forest survey of a property such as this, it is customary to cruise the old growth timber so as to furnish an estimate of the net volume of merchantable timber exclusive of defect and breakage. The young immature stands on the other hand are usually examined in such a way that the average basal area per acre may be determined, and thence the stocking. Rough volume estimates may be made then by reducing normal yields according to the stocking values. Neither the stocking ratios nor the resulting volumes however, include any recognition of defect that may be present when the stands are harvested or of breakage in logging. The old growth volumes then are not comparable with the immature volumes, the former being on a net, the latter on a gross basis. Defect and breakage in merchantable second growth ordinarily amount to about 10 percent. The gross volume equivalent of the old growth stock would therefore be about $\frac{900M}{0.90}$ = 1,000M board feet, and this value is comparable with the immature values. What breakage and defect allowances were actually made for the old growth is not important. We merely need at this point a volume equivalent of the old growth in terms of second growth. The need of this will be demonstrated later.

For this type of property Hanzlik's formula has been used widely. It is expressed as:

A.C. $= \frac{Vm}{R} + I$, wherein:

Vm is the mature timber volume, or the old growth volume. For an estimate of the gross annual cut it amounts to 1,000M board feet.

R is the contemplated rotation age—100 years.

I is the mean annual increment of the immature stands at rotation age. There are 80 acres of immature stands, the stocking ratio is 0.633, and the normal yield at 100 years is 62,800 board feet. I is therefore:

$\frac{0.633 \times 62.8M \times 80}{100} = 31.6M$ board feet.

The annual cut is then,

A. C. $= \frac{1{,}000M}{100} + 31.6M =$ 41.6M board feet per 100 acres of property.

In the original application of the formula, I was computed by adding ½R years to each immature age class, and thence determining the total actual mean annual increment for the property at the increased ages. A recent revision however as described by the West Coast Forestry Procedures Committee has been used above. A further improvement could still be made by defining I as: the mean annual increment of the immature stands at the average age at which the immature stands will be cut. As demonstrated below the average cutting

TABLE 4.—SUMMARY OF AREAS AND GROWING STOCK CONDITIONS FOR CASE C, ON A PROPORTIONAL AREA BASIS

Age class Years	Proportionate area Acres	Stocking ratio	Growing stock vol. M.B.M.
—10-0	15	Satisfactorily stocked	
0-10	25		
10-20	15		
20-30	10	0.60	
30-40	10	0.60	14.4
40-60	5	0.76	94.3
Sub-total or average	80	0.633	108.7
Old growth	20		900.0
Total	100		1,008.7

age is estimated to be 87 years. The normal yield at 87 years is 52,000 board feet. I is therefore:

$$\frac{0.633 \times 52.0M \times 80}{100} = 26.2M$$

board feet for the 80 acres of immature stock;

and A. C. $= \frac{1,000M}{100} + 26.2M$

$=36.2M$ board feet per 100 acres of property.

Having an estimate of the average cutting age however, the more direct solution already demonstrated for Case A and B, and which is demonstrated again for Case C below, will provide a superior estimate.

For solution by the Austrian formula,

Ie $= 0.633 \times 62,800 =$ 39,700 board feet

Ge $= 0.633 \times 2,083,000 =$ 1,318,500 board feet

Ga $= 1,008,700$ board feet

and the annual cut is,

$$\text{A. C.} = 39,700 + \frac{1,008,700 - 1,318,500}{100} = 42,800$$

board feet per 100 acres of property, a value quite close to that obtained by Hanzlik's formula.

To solve this problem by the method based on average cutting age, it is necessary to derive first an age-equivalent of the old growth stands. The gross volume-equivalent has been established at 1,000M board feet on 20 acres. The average gross volume per acre is therefore 50M board feet. If instead of the old growth we had immature stands with a volume of 50M board feet per acre, and if stocking were 0.633 as in the other immature stands, the corresponding normal volume per acre would be $\frac{50M}{0.633} = 79M$ board feet per acre. By referring to the normal yield tables it will be found that this volume is produced at 130 years on land of site quality III. Our old growth stock is therefore the equivalent of immature stock of 130 years. Assigning this age to the old growth, the average weighted age of all the stock will be found to equal 37 years. For a normal distribution of age classes the average weighted age would be 50 years. There is an age disadvantage then of 13 years, and the average cutting age should be approximately 100 minus 13 or 87 years. The estimated annual cut is then $0.633 \times 52.0M$, (the latter value being the normal yield at 87 years) $= 32.8M$ board feet per 100 acres of property. This value is materially lower than the two former estimates.

A cutting time computation based on 32M board feet provides for 103 years. The real value is closer theoretically to $\frac{32M \times 103}{100}$ $= 33M$ board feet, and again the new method has provided a much superior estimate.

Summary of Estimates

For the three cases presented, the gross annual cutting volumes have been estimated first, by short cut approximation formulas or procedures. As stressed by the West Coast Forestry Procedures Committee (8) these values should be considered only as first approximations or starting points for a total cutting time computation, the outcome of which will indicate any needed revision. We must have some preliminary estimate from which to start the time computations and the nearer this estimate is to the real value, the less effort it will take to establish it. In all three cases examined the procedure based on average cutting age has proved to yield the best value. A summary of the results is provided in Table 5.

Adjustment for defect and breakage and improvement in stocking.—Determinations of gross volumes have been made purposely in the foregoing examples in order to avoid the introduction of unnecessary complications. This basis is entirely satisfactory and perhaps preferable as a means of comparing the results of the various methods used to derive a preliminary estimate of the annual cut. Of more practical interest however are the net cutting volumes. Some reductions from normal yield table volumes would be realized from defect and breakage in addition to the reductions for stocking already allowed. Defect in second growth Douglas-fir is not heavy generally, a rough average being about two percent. Breakage varies widely depending upon character of ground and roughness of topography. The average is about 8 percent, and the total for defect and breakage would amount to about 10 percent. The net annual cutting volume after breakage and defect would amount to 90 percent of the gross values.

Another important factor which might be considered is the im-

TABLE 5.—SUMMARY OF ESTIMATES OF THE ANNUAL CUT COMPUTED BY THE VARIOUS METHODS

Basis of estimate	Estimates of annual cut M ft. B.M.					
	Case A		Case B		Case C	
	Unadjusted[1]	Adjusted[1]	Unadjusted	Adjusted	Unadjusted	Adjusted
Austrian formula	38.0	40.3	51.6	60.2	42.8	44.5
Hanzlik formula	—	—	—	—	41.6	43.4
Av. cut. age	31.3	33.2	48.0	56.0	32.8	34.2
Time comp.	33.0	34.9	48.0	56.0	33.0	34.2

[1] Unadjusted values exclude, adjusted include allowance for improvement in stocking and for losses from breakage and defect.

provement in stocking which usually takes place in understocked immature stands as they approach maturity. Briegleb and Girard (*2*) and Bruce (*3*) have provided means for estimating this improvement. The Weyerhaeuser Timber Company (*7*) has extended the work of reference (*2*) by compiling empirical yield tables which are self-adjusting in this respect. The application of Bruce's table to Case A indicates that the average improvement of stocking in the immature stands before cutting would amount to about 12 percent. This would mean a final stocking of 0.80 instead of 0.68. The net annual cutting volume as estimated by Austrian formula in Case A after allowing for both improvement in stocking and breakage and defect would be:

$$38.0\text{M} \times \frac{0.80}{0.68} \times 0.90 =$$

40.3M board feet.

Similar adjustments for the estimates made by the other methods are recorded in Table 5. In Case B the average improvement in stocking is estimated to be 19 percent, and breakage and defect 10 percent, in Case C 10 percent and 10 percent, respectively.

The adjusted cutting volumes may be determined prior to the time tests, as has been demonstrated by the West Coast Forestry Procedures Committee. Then these adjusted values are tested and revised until a satisfactory time check is obtained.

Summary

Preliminary estimates were made of the gross annual cutting volume for three widely different examples of Douglas-fir forest-properties consisting of even-aged stands. All examples were irregular with respect to the age class distribution and to density of stocking. In all examples (A, B, and C) estimates were made by the Austrian formula and by a new method based on determination of the average age at which the stands would be cut. In Case C an additional estimate was secured by using Hanzlik's formula. These preliminary estimates served as a starting point from which the true annual cut was established by a trial and error procedure, at a level which would provide for R years of continuous operation. In all three cases the new method based on average cutting age yielded a superior estimate. The new procedure is described in four simple steps on page 273.

After gross annual cutting volumes were obtained, adjustments were made for defect and breakage and for improvement in stocking that may be expected in immature stands before they are harvested.

Literature Cited

1. BRIEGLEB, P. A. 1942. Progress in estimating trend of normality percentage in second-growth Douglas-fir. Jour. Forestry 40:785-793.
2. ———, and J. W. GIRARD. 1943. New methods and results of growth measurements in Douglas-fir. Jour. Forestry 41:196-201.
3. BRUCE, D. 1948. A revised yield table for Douglas-fir. Pacific Northwest Forest and Range Exp. Sta. Portland, Oreg.
4. CHAPMAN, H. H. 1931. Forest Management. J. B. Lyon Co. Albany, N. Y.
5. HANZLIK, E. J. 1922. Determination of the annual cut on a sustained yield basis for virgin American forests. Jour. Forestry 20:611-626.
6. MATTHEWS, D. M. 1935. Management of American forests. McGraw-Hill Book Co., Inc., New York and London.
7. MCKEEVER, D. G. 1947. Empirical yield tables for Douglas fir. Weyerhaeuser Timber Co., Tacoma, Wash.
8. WEST COAST FORESTRY PROCEDURES COMMITTEE. 1950. Report No. 5. Determination of the allowable cut for forests in the Douglas fir region. Western Forestry and Conservation Association, Portland, Oreg.

Some Effects of Sheep Grazing on Longleaf Pine[1]

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The open range in southern Mississippi tends to be an unfavorable environment for longleaf pine seedlings. One reason is the presence of the piney woods sheep—a nondescript offshoot of the Spanish Merino, introduced to this country some 375 years ago.

PINEY WOODS SHEEP are known to feed on longleaf pine in two ways: they eat entire seedlings in the cotyledon stage, and they nip the buds on larger seedlings and small saplings. There is nothing new about either type of feeding, for this hardy scrub sheep has been scrounging for its livelihood in the pineries of south Mississippi for at least a century and a half, without care or attention from its owners except at shearing time.[2]

It was not until the 1930's, however, that the sheep-grazing problem began to attract some attention. At this time the U.S. Forest Service started large-scale planting on cut-over longleaf lands in south Mississippi. To protect the investment in plantations, fences were constructed around large tracts of national forest land, excluding not only the razorback hog, but also sheep. When local farmers and stock owners protested this sudden shrinkage in open range, Region 8 of the Forest Service undertook investigation of sheep grazing in relation to longleaf pine reproduction. The study began in the summer of 1939. World War II intervened after two years of intensive field work had been completed but before a final report had been prepared. In 1946 some of the study plots were remeasured and the pasture as a whole reexamined. The present paper summarizes the data gathered during the initial study of 1939-1941 and the remeasurements of 1946.

Experimental Procedure

A 1,300-acre tract on the DeSoto National Forest, Perry County, Miss. was selected for intensive study. This area is fairly typical of much cut-over south Mississippi land that is restocking to longleaf pine. It contains 110 acres of bottomland and 1,190 acres of upland. In 1939, 510 acres of the upland supported a good natural stand of longleaf reproduction, mostly below 4 feet in height. The remainder had been planted to longleaf and slash pine in the winters of 1937 to 1939. When the study began, the entire 1,300 acres was fenced with sheep- and hog-proof wire, and the area supported a three-year rough. Fire was kept out until January 1943, when a wildfire swept through the entire pasture, consuming a 7-year accumulation of rough.

U. S. Forest Service photo

FIG. 1.—A terminal and two lateral pointed, woolly buds of longleaf pine elongating in the early spring. During winter months the buds are "dormant," ranging in length from about ½ to 1½ inches, depending on size of seedling. In the growing season, the buds usually undergo at least three surges of growth and leafing out, alternating with bud setting. Thus there is opportunity for bud browsing throughout the growing season.

Twenty-two pairs of tenth-acre square plots were located on areas having adequate natural longleaf reproduction. The plots in each pair were approximately 20 feet apart. One plot of each pair was selected at random and enclosed by a sheep-proof fence. Since this fence was believed to interfere somewhat with movement of sheep over the unfenced plots, five check rows, free of obstacles, were established in areas of natural reproduction. These rows ranged in length from 1/6 to 1/2 mile and contained a total of more than 500 seedlings which were inspected as frequently as those on the unfenced plots. Since these rows confirmed the results on the plots, no further reference to them will be made.

On all sample plots, each seedling between 2 inches and 48 inches in height was tagged. All these seedlings had the pointed, white, woolly, terminal buds (hereafter referred to as either pointed or terminal buds), that indicate that the seedling has started, or is about to start, height growth (Fig. 1). Height of each tagged seedling was measured to the nearest inch in November 1939, in the winter of 1940-41, and again in November 1941. All smaller seedlings—that is, those without pointed buds—were inventoried in December 1939 and retallied 2 years later.

The first herd of sheep was turned into the 1,300-acre pasture on December 5, 1939. The plan was to attain an average stocking of one sheep per 10 acres, but mortality and other causes kept stocking for the 2-year period at an average of only about one animal per 12 acres. Even this concentration may

[1] The authors are deeply indebted to G. A. Gehrhart, formely assistant forester, Mississippi National Forests, who conducted the 2-year study and prepared a preliminary report on which this paper is largely based. They also wish to thank Region 8 of the U.S. Forest Service for making the basic data available.

[2] Carman, E. A., J. A. Heath, and J. Minto. Special report on the history and present condition of the sheep industry of the United States. U.S. Dept. Agric. Bur. Anim. Indus., 1000 pp., illus. 1892.

have been higher than is commonly found on the open range; but because sheep graze in flocks of varying size, locally they may frequently surpass this intensity of feeding.

All sheep were removed from the pasture on December 1, 1941, after approximately 2 years of continuous grazing. During this period they received no supplemental feed or salt, and no care except at shearing time in June 1940 and 1941.

From November 1939 to December 1941, monthly records were kept on a total of 3,117 tagged seedlings on the grazed plots. In March 1946, twelve pairs of plots were remeasured to determine recovery of injured seedlings and any differences in growth and mortality between fenced and grazed plots. Remeasurement of the remaining ten pairs of plots was omitted mainly because army maneuvers had damaged some of them, and on others the wildfire had consumed too many tags to permit ready identification of specific trees.

Extent and Frequency of Bud Nipping

During 2 years of continuous grazing, 86 percent of the tagged longleaf seedlings, or 1,245 seedlings per acre on the grazed plots had their terminal buds nipped by sheep (Table 1.) Since 50 percent of the seedlings were browsed two or more times and 27 percent were nipped at least three times, a total of 1,286 terminal buds were browsed per acre per year. The proportion of trees affected by grazing ranged by plots from 74 to 96 percent.

Effect of Grazing

On height growth.—During 2 years (1940-41) of continuous grazing height growth was somewhat retarded. Average 2-year height growth of tagged seedlings was 11.5 inches on grazed plots in contrast to 15.5 inches on fenced plots. The mean difference of 4 inches is significant at the 1 percent level. Retardation of growth was naturally greater on smaller seedlings. Those from 2 to 24 inches in height showed a growth loss of 45 percent, against a loss of only 3 percent for those 25 to 48 inches tall.

TABLE 1.—EFFECTS OF 2 YEARS OF CONTINUOUS GRAZING ON LONGLEAF PINE SEEDLINGS AND SMALL SAPLINGS ON THE DESOTO NATIONAL FOREST, MISSISSIPPI (1939-1941)

Height	Tagged trees per acre	Trees injured per acre			
		Once or more		Twice or more	
Inches	*Number*	*Number*	*Percent*	*Number*	*Percent*
2- 5	426	369	87	161	38
6-10	454	429	94	281	62
11-15	186	181	97	143	77
16-20	103	100	97	82	80
21-25	75	69	92	41	55
26-30	58	50	86	8	14
31-35	47	30	64	2	4
36-40	38	15	39	0	0
41-45	35	1	3	0	0
46-48	20	1	5	0	0
Total	1,442[1]	1,245	86	718	50

[1] Average stocking on the fenced plots was 1,486 tagged seedlings per acre.

During the following four years (1942-1945), height growth of surviving tagged seedlings averaged 6.4 feet on grazed plots against 6.6 feet on plots not grazed, indicating satisfactory recovery of height growth from the effects of grazing.

On mortality.—From November 1939 to December 1941, 4.6 percent of all tagged seedlings on the grazed plots died, as against 2.3 percent on the plots not grazed. This difference is insignificant. Subsequent mortality in tagged seedlings up to April 1946 was 40.8 percent on grazed plots and 34.2 percent on the protected ones. This difference is significant at the five percent level. Most of the mortality from 1942 through 1945, however, can be traced to the wildfire which caused somewhat greater losses in seedlings that grazing had made more vulnerable to fire injury.

U. S. Forest Service photo.

FIG. 2.—Longleaf pine seedling with needles stripped to show result of repeated terminal bud injuries. This is a severe case.

Loss from trampling and eating of small, untagged seedlings below 2 inches in height was indicated to be over 350 per acre during the 2-year grazing period. Since the fate of the untagged seedlings was not systematically followed in this study, no further reference to them will be made.

On tree form and recovery.—Four years after sheep were removed from the pasture, 15 percent of the surviving tagged seedlings were found to be so badly deformed or stunted that they would probably never make suitable crop trees (Fig. 2). Repeated loss of terminal buds causes malformation in seedlings even though it may not kill them, and basal and stem scars make such seedlings vulnerable to cat-facing from fire.

Factors Influencing Incidence of Bud Nipping

Seedling size.—Bud nipping of saplings taller than 48 inches was not systematically recorded but appeared negligible. The most vulnerable height range was from 11 to 20 inches, where 78 percent of the seedlings were browsed two or more times. Below six inches the proportion of affected seedlings fell off somewhat, and above 25 inches there was a sharp drop (Table 1).

Form and length of buds.—Browsing was confined to the

pointed buds. Some flat or slightly rounded white, woolly buds also occur on longleaf pine; but these are ignored by sheep, probably because browsing them might require chewing some pine foliage, which sheep avoid except when seedlings are very young. Length of buds doubtless also influences incidence of browsing. However, bud lengths were found to vary only slightly with seedling size. Winter measurements of over 2,000 pointed buds on seedlings ranging in height from 2 to 37 inches showed average bud lengths to range from 0.56 inch for 3-inch seedlings to 1.56 inches for 36-inch seedlings. No pointed buds less than 0.4 inch were encountered.

Season.—Nipping of terminal buds was greatest in the winter and early spring months. Of the 2-year total of 2,572 terminal buds nipped per acre, 38 percent were browsed from January through March, 22 percent from April through June, 11 percent from July through September, and 29 percent from October through December.

The seasonal trend undoubtedly relates in part to the supply of pointed buds, which reaches a low point in summer, and in part to the greater abundance of succulent weeds, grass, and shrubby vegetation in the spring and early summer months.

Grazing habits and forage preferences.—Piney wood sheep tend to be least active in spring and summer. In the winter, animals on the study area occasionally ranged 1½ miles in a single day in search of food. Their winter diet consisted chiefly of herbaceous weeds, waxmyrtle and gallberry leaves, and species of wiregrass, as well as pine buds.

In the spring, blackberry buds and leaflets provided an early and much relished food. Slender and little bluestem, commonly called "broomsedge," formed the major diet until midsummer, when these grasses toughen and dry up. Huckleberry, sweetleaf sumac, blackgum and sweetgum, and dogwood leaves were browsed throughout the spring, summer, and early fall.

From August until frost, weeds

U. S. Forest Service photo.

FIG. 3.—This ewe was caught in a characteristic pose while nipping the terminal bud off a longleaf pine seedling approximately 2 feet in height.

—mainly of the *Compositae* family (including goldenrod, dwarf sunflower, vanilla plant, fineleaf blazingstar, grassleaf goldaster, and others)—were heavily grazed.

During dry spells in the fall, the sheep worked down to the swamp margins and stream bottoms to feed on maples, greenbriars, and bays. Ordinarily, sheep shy away from swamps and boggy areas, showing a decided preference for dry sites.

Although browsing of longleaf pine buds was heaviest during periods when native forage was sparse, unpalatable, or low in nutrient content it, nevertheless, occurred in all seasons (Fig. 3). This has led to speculation that the buds contain some important dietary ingredient that is lacking in other native forage. Analyses of pine buds collected in December, March, and April did reveal some nutritional differences between them and slender and little bluestems, which sheep eat extensively in the spring and early summer. But for comparable periods, the main differences were in mineral content, which was higher in the grasses.[3]

From the meager evidence on hand, it appears that sheep eat pine buds because they are hungry.

Discussion

This study focuses attention on the nature and extent of sheep browsing on pointed buds of longleaf pine. When such feeding recurs on terminal buds, height growth is reduced, mortality is increased, and the tree may be deformed.

A possible criticism of this study is the presence of the old rough, which had accumulated for 3 years when the study began and was 5 years old when the sheep were removed. Much of the open-range grazing in south Mississippi occurs on rough from 1 to 2 years old.

For a number of reasons, however, the study appears to be a conservative assay of effects from sheep grazing. It was established on an area where many seedlings had begun height growth; some grew beyond the reach of sheep after the first year. Although nipping was confined to seedlings with pointed buds, in a longleaf stand about to commence height growth, such seedlings are the very ones most likely to grow into crop trees. Grazing was stopped after 2 years, which was too brief a period to show the effects of prolonged and recurrent de-budding on mortality, growth, and form. Moreover, the study did not systematically follow losses of newly germinating and other small seedlings by trampling and eating.

Experience and observations, in addition to this detailed study, indicate that successful regeneration of longleaf pine at reasonable cost may be difficult where sheep graze continuously at intensities as high as one animal per 12 acres. Although browsing is heaviest during winter and early spring, enough seedlings get nipped during summer and fall months to make year-long protection seem desirable.

Longleaf seedlings more than 48 inches in height are practically beyond the range of any bud browsing by sheep. It might seem that keeping sheep out of areas that are undergoing restocking until an ample number of potential crop

[3] Wahlenberg, W. G., S. W. Greene, and H. R. Reed. Effects of fire and cattle grazing on longleaf pine lands, as studied at McNeill, Mississippi. U. S. Dept. Agric. Tech. Bul. 683, 52 pp., illus. 1939.

trees have grown above the vulnerable height range would solve the sheep-grazing problem. In practise, the problem of managing sheep on longleaf lands is much more complex. Until large blocks of longleaf pine are reproduced on an even-aged basis and fenced, attempts to manage sheep and seedlings on the same land may turn out to be a somewhat costly venture.

Summary

The effect of sheep grazing on longleaf pine was studied intensively for 2 years in a 1,300-acre pasture in Perry County, Miss. The pasture was stocked at the rate of 1 head per 12 acres. Main observations and measurements were carried out on seedlings between 2 and 48 inches in height on 22 pairs of tenth-acre plots, one of each pair being fenced and the other left open to yearlong grazing. Average stocking of sample seedlings was 1,486 per acre on the fenced plots and 1,442 per acre on the grazed plots.

1. During two years of continuous grazing, 86 percent of the sample seedlings were browsed by sheep, which nipped 1,286 terminal buds per acre per year. Fifty percent of the seedlings lost their terminal buds two or more times.

2. Browsing of buds was negligible on trees more than 48 inches in height and heaviest in trees less than 24 inches, but enough choice seedlings and small saplings between 24 and 48 inches were nipped to warrant protection of stands from sheep grazing until seedlings are at least 4 feet tall.

3. Mortality directly attributable to sheep grazing was not heavy, but some 15 percent of the browsed seedlings were so badly deformed that they may never make suitable crop trees.

4. Height growth on sample seedlings (between 2 and 48 inches in height) averaged 25.8 percent less on grazed plots than on fenced plots. Much of the loss in growth was in seedlings less than 2 feet tall when buds were nipped.

5. Browsing was somewhat seasonal, being heaviest from October through March, and being related to the abundance of white, woolly, pointed buds. However, enough buds were eaten during the summer months to suggest that yearlong protection of longleaf pine against sheep may be desirable until the seedlings reach 4 feet in height.

History of Government Timber Sale Number One[1]

Orlo M. Jackson
District ranger, Black Hills National Forest, Nemo, S. Dak.

IN 1897 THE ORGANIC administration act provided for protection and actual timber sale provisions for application to the forest reserves. The Black Hills Forest Reserve was set aside by President Grover Cleveland on February 22, 1897 and in the latter part of 1897 the General Land Office at Washington received an aplication to "purchase all of the timber of a diameter of eight inches and over" on the area now known as old Case 1. This aplication was made by Mr. T. J. Grier, superintendent of the Homestake Mining Company.

Following the receipt of this application, instructions were issued from Washington in May 1898 by the commissioner of the General Land Office to Special Agent Greene at Rapid City, South Dakota to make an examination and report. The letter of instructions is quoted in part as follows:

> Your report should cover, in *every detail*, the points specified in paragraph 23 of circular of June 30, 1897, containing forest reserve regulations; and should also estimate the number of trees which it is desired to cut annually, as well as show the kind of trees; the average diameter of same; whether they are growing or dead; the number of feet, board measure, contained therein; the appraised value of same; whether a public necessity exists for the use of this timber, or whether the removal of same will be detrimental, *in any respect*, to the public interest; and, if the sale is desirable, what would be deemed a fair and reasonable charge therefore (per thousand feet), as compared with the cost of timber procured through other sources in that vicinity. In doing so, you will make special inquiry regarding available sources for procuring needed timber in that vicinity and state whether sufficient timber to supply the several companies represented in this petition cannot be procured from owners of private lands at a reasonable cost.

Apparently no action was taken by Special Agent Greene to obtain the information desired by the commissioner, for under date of August 26, 1889 H. G. Hamaker, forest supervisor located at Custer, was advised that the petition of Mr. Grier was to be turned over to him together with instructions directing an investigation and report upon the matter.

On April 25, 1899, Supervisor Hamaker submitted a report to the commissioner. The report was rejected and returned for correction and additional information. It should be noted that the commissioner seemed reluctant to start a precedent by approving a sale of timber on the public domain.

On June 24, 1899, Mr. Grier filed an amended application describing the area as sections 1, 2, 3, 4, 9, 10, 11, and 12 of T.2 N., R.5 E., all trees 8 inches and larger to be cut.

On the basis of the amended application, Supervisor Hamaker, on June 28, submitted a new report. Then, under date of August 14, 1899, the commissioner authorized the publication of the sales notice at the following prices:

[1] Information for this history was obtained from the Cumulative Silvical Report of the Black Hills National Forest and from talks with James W. Estes, retired superintendent of the Homestake Sawmill and woods operations, who worked on old Case 1 as a boy.

One dollar per thousand feet for green sawtimber, 50 cents per thousand feet for standing dead timber, 25 cents per cord for wood from the tops and branches of the said 66,300 live Norway pine trees, and 15 cents per cord for the down dead timber. The Norway pine referred to is what is now known as ponderosa pine.

The advertisement as it appeared in the paper is of particular interest when compared with such advertisements today, especially as to the wording and length required. The advertisement for the timber in the Case 1 sale was run in a single column and required approximately 7 inches of column space:

Notice

Secretary of the Interior, General Land Office, August 4, 1899

Notice is hereby given that sealed bids, addressed to the Commissioner of the General Land Office, will be received by the Receiver of the United States Land Office, Rapid City, South Dakota, up to and including October 19, 1899, for the purchase under the Act of June 4, 1897, (30 Stat., 34-36), of a sufficient number of live Norway pine trees, say 66,300 trees, ranging in diameter from eight to fourteen inches and upwards, to yield an aggregate of 13,989, 300 feet board measure, and 5,100 cords from tops and lops of the said live trees; also the dead trees now standing—say 5,100—containing 1,530,000 feet board measure: All of the above timber, together with all the down dead timber now thereon, to be taken from the following described tract of public land, within the Black Hills Forest Reserve (exclusive of all valid mining and other claims on the said land) to wit:

Section one (1), two (2), three (3), four (4), nine (9), ten (10), eleven (11), and twelve (12) in Township two (2) North of range five (5) East, B.H.M.

The said live timber will not be sold for less than $1.00 per thousand feet, board measure, and 25 cents per cord. The said standing dead timber for not less than 50 cents per thousand feet; and the said down dead timber for not less than 15 cents per cord.

A deposit of $250.00 with the Receiver will be required with each bid, and payment in full must be made within thirty days after notice of award, or in equal payments in thirty, sixty and ninety days, at the option of the purchaser.

The live timber to be cut will be marked and designated by the official under whose supervision it will be cut.

Each bidder must guarantee in his proposition to purchase that he will use all of each standing tree as fast as it is cut down; and that the refuse therefrom and from the cutting of the dead timber will be piled ready to be burned under the direction of the official designated therefore; and that no timber will be transported out of the State of South Dakota.

No timber can be cut or otherwise disposed of until after payment therefor.

Purchasers failing to remove all the timber within one year from the date of the notice by the Receiver of the award forfeit both purchase money and right to timber unremoved, unless an extension of time be obtained.

The right is reserved to reject any and all bids.

W. A. RICHARDS,
Acting Commissioner.

Fig. 1—Old String Town Logging Camp on Jim Creek, 1900.

Fig. 2—Old String Town Logging Camp site in 1950.

Cutting on the sale began about Christmas of 1899 and after four extensions of time the sale was finally closed in April 1908. Eight contracts were let for the eight sections comprising the sale. Only the more accessible areas were cut because of the plentiful supply of timber in the surrounding areas and the difficulty in breaking with an old habit.

In spite of the good intentions as indicated in the advertisement of the sale, cutting operations seem to have followed very much the same pattern as those on private land. In general, four types of products were cut: sawlogs, 11-inch timbers (hewed two sides and peeled two sides with hewed sides being 11 inches through), 6-inch lagging (hewed two sides and peeled two, with hewed sides being 6 inches through), and cordwood. The first three products were taken in one operation and the cordwood cut-

ting followed as a second operation and utilized all rotten logs, tops, butts, large limbs, and trees down to 4 inches. During the cordwood operation all slash was piled (although the records show it was poorly done and otherwise subject to human frailties) and burned by the Forest Service at a later date with day laborers.

No cull deductions for log defects were made, but each log was considered completely sound or a complete cull.

Figure 1 shows the old String Town Logging Camp on Jim Creek at about 1900, and Figure 2 shows approximately the same view in 1950. Figure 1 also shows, on the left side, three of the four products cut from the sale and shows plainly the heavy utilization practices of the operation.

Figure 2 was taken about 100 feet lower than Figure 1. This was necessary because of a heavy growth of "jack" pines in front of the spot from which the original photo was taken. The numeral *1* on each photo shows an old barn which was present for both pictures. Numeral *2* on each photo shows a tree that was present in 1900 and is still standing.

At the beginning of the sale there seems to have been no policy for marking, but as the sale progressed trees were marked for cutting with an axe and a "U.S." written on the blaze with a pencil. The marking hatchet with the "US" on the back, as we know it today, seems to have first made its appearance on Case 100 in 1902. Case 100 joined Case 1 on the northwest corner, but by 1902 the sale administration functions were better organized and the first real selective logging began to make its appearance.

All sawlogs from Case 1 were hauled by team and wagon to the Homestake Mill in Nemo which was built in 1899 and had a capacity of 13,000 feet per day. Lumber, timbers, lagging, and cordwood were then transported to Lead City by narrow gauge railroad for use in the Homestake Mining Operation.

Payments for the timber were made in three installments of $5,343.10 each. Timber to the value of $14,967.32 was cut, indicating that the cutting underran the estimate by approximately a million feet. An overun would undoubtedly have occurred had it not been for the "highgrading" practiced at the time by all timber operators.

A partial list of forest officers administering the sale would include J. F. Clark, W. H. B. Kent, Smith Riley, Arthur McCrady, George Lytle, Fred Whitney, Arthur Lynn, and N. E. Peterson.

In 1924 sample strips were run on this area to determine the rate of growth since cutting. The study showed an average stand of 482 board feet per acre left after cutting. Twenty-four years after cutting, the stand per acre was 2,611 board feet, an increase of 2,129 board feet, or 441.6 percent.

Old Case 1 served as a start or a spring board from which selective marking policies and logging requirements began to develop in the Black Hills. The speed with which a good selective marking policy developed is evidenced by the recent sale of 3,000 board feet per acre from the old Case 100 sale area. This sale was made just three years after Case 1 "broke the ice" and led the way for sale of government owned timber from the Forest Reserves.

Notes

Fall Planting Can Be Successful

Tree planting in the southern part of the Central States region has usually been done during a 6 to 8 weeks period starting about March 1. This restricts planting programs and adds to the heavy spring work load of farmers or foresters. Successful planting during other periods would speed completion of the large planting job and be especially valuable when public money is available for large planting programs. Late spring planting of cold storage stock is one way to extend planting time; another, and perhaps even better solution, is fall planting.

Earlier trials of fall planting on the upland soils of southern Illinois and similar regions usually showed poor survival. The chief cause of tree mortality was frost heaving on the old field planting sites often freshly abandoned as farm land and with only a sparse cover of annual weeds and grasses.

By the late 1940's ecological succession and fire control practices in some of these areas had greatly altered the cover types on the older abandoned fields. On the better, less eroded sites, perennial vegetation of broomsedge (*Andropogan* spp.) or broomsedge mixed with scattered weeds, brush, and blackberry briars was well established. A cover of surface mulch has developed and the structure of the soil, compared to the condition when abandoned, had improved considerably. The poorer, more heavily eroded, and recently abandoned sites still had a sparse cover of annual weeds and grasses with little surface mulch or improvement in soil structure.

Considering these conditions, it was decided to test fall planting of shortleaf pine as related to planting methods and vegetational cover types on the upland old field planting sites of southern Illinois. Only medium or heavy density cover types were considered in the experiment. Areas nearly bare or with a light cover (density less than about 0.5)[1] were omitted as known poor risks for fall planting. The cover types included were (1) annual weeds and grasses, density 0.5 to 0.8, (2) broomsedge or broomsedge mixed with briars and some annual weeds, density 0.6 to 0.9, and (3) broomsedge mixed with sassafras-persimmon-hickory brush, density 0.7 to 0.9. The trees were planted by the side-hole and mattock-slit methods with a 10-inch scalp removed and unscalped in nine experimental blocks of four plots each.

Examination of all plots in June following fall planting showed a marked influence of vegetational cover types and planting methods on frost heaving (Table 1). It was evident that scalping greatly increased frost heaving of fall-planted pine and that perennial vegetation composed chiefly of broomsedge was a better protective cover than annual weeds and grasses. The mattock-slit method, unscalped, gave the least frost heaving. For unscalped plantings on broomsedge areas only 10 percent of the mortality was caused by frost heaving. Most of the rest was caused by excessive drying of plant tissues during the first winter before the roots became well established.[2]

Two series of pilot-plant tests of fall planting on broomsedge cover were later established, one in October 1948 and one in October 1949, to determine survival of shortleaf pine planted under field conditions in early fall.

In the 1948 pilot-plant tests the mattock-slit method, unscalped, gave 75 percent survival the first year. Only 6 percent of these trees were frost heaved. The mattock side-hole method with a minimum (6-inch) scalp removed gave 69 percent survival and 38 percent of all trees showed frost heaving.

TABLE 1.—FROST HEAVING OF FALL-PLANTED SHORTLEAF PINE AS RELATED TO VEGETATIONAL COVER AND SCALPING

Vegetational cover type	Percent of total trees frost heaved	
	Scalped	Not scalped
Annual weeds and grasses	54	10
Broomsedge or sedge and briars	13	4
Mixed broomsedge and brush	15	5

Machine fall planting tried in 1948 was a failure because of excessive frost heaving. Spring machine planting has been successful, but the machines do not operate well when the clay soils of the region are wet and sticky. Further trials are needed for both fall and spring machine planting.

In October 1949 the bar-slit and mattock-slit methods, both unscalped, were tried on four broomsedge areas of about one acre each. First year survival averaged 84 percent of the bar-slit method and 76 percent for the mattock-slit method. Little or no importance can be attached to this small difference on the basis of the present data.

Conclusions

The recommended conditions for successful fall planting of shortleaf pine in southern Illinois and similar adjacent regions include a cover type of broomsedge, broomsedge mixed with scattered briars and/or brush, or mixed broomsedge and annual weeds. Dense brush and briars should be avoided. Plantings made early in the fall, as soon as planting stock in the nursery has "hardened off," have a better chance of surviving.

Stock should be of good plantable grade as vigorous stock is more important for fall than for spring planting. Planting should be done by either the bar-slit or mattock-slit method, unscalped,

[1] Estimated proportion of ground covered or shaded by vegetation cover.

[2] These early plot tests were established in December and mortality was moderately heavy because of winter desiccation.

and additional care should be taken to pack soil firmly around the roots.

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Natural Reproduction from Redcedar

Although the seeds of many shrubs and herbs are disseminated by birds and other animals, the seeds of only a few commercially important tree species are distributed in this way. *Juniperus virginiana*, L. is one valuable species whose seeds are largely distributed by animals. In spite of its value and wide distribution, redcedar is seldom handled under any definite silvicultural system.

In the northern states old field stands are often cut whenever convenient since even when the cedars are killed by the crowning of their species they remain more or less intact and undecayed. In the southern states redcedars are able to survive in many hardwood understories and are usually left to struggle along in this condition, barely surviving from year to year. A system of thinning has been recommended for the few existing redcedar plantations in the South and the species is often encouraged by cleanings when it occurs in mixed stands. However, this is about the extent of systematic management employed. One exception to this is on the Duke Forest in North Carolina where redcedar is protected from fire, and has been managed from natural reproduction with considerable success.

Observations by the writer in the Duke Forest and vicinity showed that birds remove the fruits or cones from the trees especially when there is snow on the ground. In one mild winter, on the other hand, when there was practically no snow, the fruits remained on the trees until late February and then finally dropped off. The birds involved seemed to be chiefly waxwings and robins, although starlings and mockingbirds were also seen eating the fruits. Robins were often seen eating the fruits off the ground when the ground was frozen and their usual source of food was largely cut off. Rodents may also account for the removal of much of the seed that falls to the ground.

The question is often asked whether birds benefit the germination of the seeds by eating them. Experiments carried out by the writer showed that seeds fed to doves were entirely destroyed by digestive action. On the other hand, berry-eating birds like thrushes, starlings, and waxwings apparently do not destroy hardcoated seeds like those of redcedar. In such cases it has been found by other workers that some birds do scarify the seeds of many species and thereby hasten or improve germination.

Whatever animals may distribute the seeds it should be understood that many fruits simply fall off the trees and after their coats rot or break the seeds may germinate in one or two seasons. Removal of the fruit coats has been found to hasten germination; and some scarification of the seeds themselves hastens germination, but it is not always absolutely necessary for the seeds to be eaten by birds. It is quite possible that much of the reproduction so often found directly under open-grown redcedars has originated from seeds that have fallen from the trees.

From the silvicultural point of view it is also of interest to notice that many birds feed in groves of cedars and then either perch in the same stand or in an adjacent stand of hardwoods where the seeds are dropped to the ground in large numbers. This occurs occasionally in the South where hardwoods are adjacent to open-grown redcedars that bear a fair quantity of seeds, and undoubtedly accounts for the excellent reproduction sometimes found under such hardwood stands. Removal of at least some of the hardwoods after good establishment of redcedars is recommended in these circumstances.

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More About Pines and Fire

In my review of Eyre and Zehngraff's circular, *Red Pine Management in Minnesota*[1] which appeared on page 775 of the October 1948 Journal of Forestry I called attention to statements published by Fernow[2] in 1905, and Zon[3] in 1912, to the effect that the use of properly timed and controlled fires should play a major part in securing reproduction of both red and white pine on the newly created Minnesota (Chippewa) National Forest.

Recently I read for the first time Frothingham's bulletin, *White Pine under Forest Management*, published in 1914 after he had studied results on this forest.[4] Since in my review I intimated that the authors of the red pine circular had neglected the advice of Fernow and Zon, and were advising, nearly 50 years thereafter, that it might be a good thing to experiment with fire in securing reproduction of these species, the joke is on me that I, in turn, neglected to read Frothingham's bulletin, although it confirms the other two authors. In brief, Frothingham states:

Page 41—"In fact, a light fire just before a heavy fall of seed provided it is not allowed to spread into adjacent timber, may prove of great value by exposing the mineral soil and killing existing vegetation."

Pages 45-46—"Should a fire burn over the area just before a heavy seed year, however, and should the cutting follow immediately after seedfall, an abundant stand of pine reproduction is almost sure to come in, giving competing vegetation little room in which to grow. The problem from then on consists simply of protecting the young growth from fire.

[1]Eyre, F. H. and Paul Zehngraff. Red pine management in Minnesota. U. S. Dept. Agric. Circ. 778. 1948.

[2]Fernow, B. E. Comments on the Minnesota experiment. Forestry Quarterly 3: 107-113. 1905.

[3]Zon, R. Results of cuttings on the Minnesota National Forest under the Morris Act of 1902. Proc. Soc. Amer. Foresters 7: 100-105. 1912.

[4]Frothingham, E. H. White pine under forest management. U. S. Dept. Agric. Bul. 13. 1914.

"In most cases a careful burning over of the surface prior to the seed fall is necessary.

"The seed tree method . . . on the Minnesota [Chippewa] National Forest . . . has not proved satisfactory except under accidental combinations of circumstances, such as the occurrence of some ground fires before and not after a seed fall.

"In the absence of cultural fires to free the ground from competing growth before the seed fall, the benefits of cutting during seed years are minimized, since most of the reproduction, even if abundant, is killed by the dense brush that springs up. On some areas which had been burned over during the spring and summer of a seed year and logged the following fall or winter, reproduction was excellent. On many of these, however, the young pine was killed by subsequent fires, and before the next seed year the ground was again covered with brush.

"If, however, too much brush has sprung up since the first cutting, the ground should be thoroughly burned over in the spring or summer of the seed year in which the second cutting is made, and seed trees or even enough of the stand to warrant a later cutting left on the ground.

"The seed tree method may be used with good results if the cutting—made during a full seed year—is preceded by a thorough surface burning. Seed trees should be protected from surface fires by trenching or some other means. Before each subsequent seed year, areas on which reproduction is poor should be carefully burned over."

In a study of methods of cutting pure even-aged old field white pine stands in Massachusetts on which I was engaged in the summer of 1950 it became strikingly evident that in "seed tree" cutting, despite the presence of the seed trees, when the duff from the old stand remained undisturbed, the seedlings perished from desiccation. But under shelterwood or group selection cuts where shade was present they survived. Fire has not been systematically tested as an aid to white pine reproduction in New England, and the natural tendency is to avoid its use if other methods can succeed. But we must be sure they *are* succeeding.

The main purpose of this note is to emphasize the importance of reviewing past literature on any subject presenting present problems, rather than start from scratch, thereby, perhaps, losing half a century of experience and guidance.

H. H. CHAPMAN.

Forest Fire Smoke of September 1950

Foresters who recall the smoky skies of last September over the north-central, New England, and Atlantic coastal states may be interested in two recent reports of this event. One article by Smith[1] describes the meteorological condition associated with the smoke layer; the other, by Wexler[2] describes the insolational and optical effects. Both authors are associated with the Weather Bureau.

The smoke, according to the authors, originated in northwestern Alberta and northeastern British Columbia from over 100 forest and muskeg fires burning during September 17-27. Meteorological conditions had much to do with the formation, accumulation, and movement of the resulting smoke. First, a 3-week drought preceded the fires. Then, the smoke, carried upward several thousand feet by the heated, rising air accumulated due to absence of strong winds. Beginning September 22, the smoke began to move southward and eastward and while so moving was picked up by rapid wind currents and carried at speeds greater than 50 miles per hour. These currents were the reason the smoke layer covered large areas in the United States. Once reaching and covering these areas, the strong winds failed. With the light winds then prevailing this part of the smoke layer persisted for about a week. Another part was picked up by westerly winds, carried over the Atlantic, and observed in northern England, France, Portugal, Denmark, and Switzerland on September 26 and 27.

Smoke observed in eastern United States largely occurred in a layer between elevations of 8,000 and 15,000 feet. At Washington, D. C., on September 25-26, with no daytime clouds reported, this layer cut off 54 percent of the expected insolation. Consequently, temperatures were reduced. Forecasts of maximum temperatures (Fahr.) for the 4-day period were 64°, 64°, 64°, and 70°; observed were 54°, 59°, 63°, and 66°.

The most striking result was the colored appearance of the sun and moon. Sun coloration was variously described as dull red, copper, orange, greenish-yellow, pink, silver, purple, blue violet, and lavender. In Scotland, Denmark, and Belgium a blue sun was reported.

As far as is known, this was one of the greatest accumulation and coverage of forest fire smoke on record. Certainly its passage was the most thoroughly reported and studied.

HOWARD W. LULL,
U. S. Forest Service,
Washington, D. C.

[1] Smith, Clarence D., Jr. The widespread smoke layer from Canadian forest fires during late September 1950. Monthly Weather Rev. 78(9): 180-184. 1950.

[2] Wexler, Harry. The great smoke pall—September 24-30, 1950. Weatherwise 3(6): 129-134, 142. 1950.

We Present

William A. Dayton

William Adams Dayton, affectionately known as Bill to his associates, is one of the outstanding forest ecologists and dendrologists in the United States.

Born in New York City, December 14, 1885, he is the son of Dr. William Adams and Emma (Samson) Dayton. He grew up in Tarrytown, N. Y., the scene of Washington Irving's "Legend of Sleepy Hollow," and was graduated from the Irving Institute (now Irving School for boys) in 1901. He went on to Williams College where he obtained his B.A. in 1905 and M.A. in 1908. Bill had worked as a teacher, clerk, farmer, and stenographer until 1906 when he joined the Post Office Department.

In 1910 he was appointed as a plant ecologist under Dr. Arthur W. Sampson in the U. S. Forest Service. In the following fall he was put in charge of range forage investigations. During the first few years he spent about half his time in Arizona, California, and Oregon making on-the-ground studies of the relation of livestock grazing to timber production and doing research in range ecology. These studies provided data basic for the formulation of the deferred and rotation system of grazing that is in general use in the national forests.

As a specialist in range forage investigations Dayton has been responsible for building up the Forest Service herbarium of more than 100,000 specimens, recognized as the largest and most complete collection of annotated range plants in the country. His range work has also resulted in the preparation of two outstanding publications of the U. S. Department of Agriculture, *Important Western Browse Plants* (1931) and *Range Plant Handbook* (1937).

The Division of Dendrology and Range Forage Investigations was established in 1942 by the Forest Service and Dayton was made its chief, a position in which he serves today.

Bill Dayton has probably done more than any other man to standardize the nomenclature of our native range plants. His interest in standardizing plant names evolved from his early work on range plants and his daily contact with hundreds of range plant specimens.

WILLIAM A. DAYTON

It was kindled by his association with such men as Dr. Sampson, George B. Sudworth, dendrologist for the Forest Service until his death in 1927, and Frederick V. Coville, late botanist of the Bureau of Plant Industry. Over the years Bill Dayton has had a profound influence on the selection of accepted plant names.

Drs. Harlan P. Kelsey and J. Horace MacFarland, recognizing his interest and the caliber of his work, requested in 1938 that he represent the U. S. Department of Agriculture on the Editorial Committee on Standardized Plant Names. With Dr. Kelsey as chairman this committee prepared the second edition of *Standardized Plant Names*, published in 1942, a truly monumental task involving the listing of some 90,000 names. Today Dayton represents the Forest Service on the Department of Agriculture committee on plant names; and the Forest Service and the Society of American Foresters have named him chairman of their committees on tree names. In 1944 his Forest Service tree name committee produced the authoritative "Check List of the Native and Naturalized Trees of the United States Including Alaska" in mimeographed form.

But Bill Dayton is no armchair dendrologist. Some of the states in which he conducted field work, mainly ecological, are Florida, Georgia, New Hampshire, New Mexico, Tennessee, and Utah.

In 1943, a forest survey party doing field work in Central America as part of a war project included Dayton as dendrologist. Two survey reports, of which he was joint author with three others, were released: "The Forests of Costa Rica" and "Accomplishments of Latin American Forest Resources Project." One of the results of his work in Costa Rica was to bring to scientific notice the existence of the giant Copey oak forest, perhaps the largest oak and the largest oak forest in the world.

Dayton is a Fellow of the American Association for the Advancement of Science and has served on its Council. He has been a vice-president of the Washington Academy of Sciences since 1938. In 1940 he was awarded a gold medal by the Massachusetts Horticultural Society. A member of the Society of American Foresters since 1919, he acted as secretary-treasurer of the Washington Section during 1933-1936, and as chairman during 1940-1941.

As American Institute of Biological Sciences representative he attended the United Nations Scientific Conference on the Conservation and Utilization of Resources held at Lake Success, N. Y., in 1949. In July 1950 he attended the Seventh International Botanical Congress held at Stockholm. While

there he was an official delegate of the Society of American Foresters. He also attended the sessions on nomenclature which preceded the Congress.

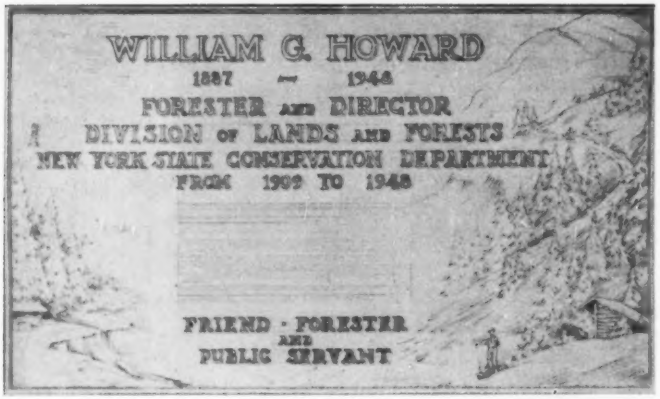
His biography appears in two of the nation's most eminent biographical reference publictions, *Who's Who in America* and *American Men of Science*.

The formidable list of scientific societies to which he belongs (and there are 18 of them) might lead a stranger to believe that Dayton is an aloof scientist in an ivory tower, hard to approach. Nothing is further from the truth. To be sure, he is an ambulatory encyclopedia of knowledge about trees, shrubs, grasses, and other plants. But this knowledge is always freely available to those seeking information, from the school child with a leaf or flower to be identified to Justice William O. Douglas making sure of the botany in his recent book *Men and Mountains*.

One, perhaps the greatest, measure of a scientist's importance and influence is the extent to which his opinions are sought and accepted by workers in his field. When information is needed by foresters and range specialists on questions of plant identity or nomenclature the problem is frequently resolved by the decision, "Let's ask Bill Dayton."

WILLIAM P. EVERARD.

Memorial Plaque to Be Erected to William G. Howard in New York State



A memorial plaque in bronze will be erected to the memory of William G. Howard, for many years director of the Division of Lands and Forests, New York Conservation Department. A Fellow of the Society of American Foresters, Mr. Howard served on the Council for two terms during 1941-1943, and had been vice president during the period 1938-1939. He died in 1948.

The plaque will be mounted in a boulder in a beautiful grove of pines in the Lake George Battleground Park, and will be dedicated by Governor Dewey early in the summer. The exact date will be announced later. All friends of Mr. Howard are invited to attend the dedication.

The design of the plaque is illustrated. In its center, not shown in the illustration, will appear the following inscription.

"In Tribute to his Service in Forestry to his State and Nation and in Recognition of his Forthright and Farseeing Administration of Forest Fire Control, State-Wide Reforestation, Forest Recreation, and of the Forest Preserve."

Members of the Society of American Foresters who would like to contribute to the memorial are invited to send contributions in amounts of $1 to $5 in care of A. S. Hopkins, director, Division of Lands and Forests, New York Conservation Department, Albany 7, N. Y. Checks may be made payable to the Treasurer, William G. Howard Memorial Committee.

Reviews

Big Hugh: the Father of Soil Conservation.

By Wellington Brink. 167 pp. Illus. Macmillan Company, New York. 1951. $2.75.

In his friendly preface to this biography, Louis Bromfield puts his finger on the essential character of Hugh Bennett. "I know him as well as I know any man alive and there is no man whom I respect and admire so much. I think this is because he has the old American virtues of integrity, simplicity, directness and honor—virtues which are not too plentiful in these times or are, at least, obscured by the age in which we live."

Not a critical biography in a literary sense, though it is skillfully written and eminently readable, the book reflects the frank admiration of an author for one who is both his friend and a former boss in the Soil Conservation Service. Here is the homespun bureau chief, the benefactor of city dweller and farmer alike, the popularizer of science, the doer impatient of inertia who puts research to work and makes soil conservation a household word. At the age of seventy, full of honors and good works, Hugh Bennett is becoming a legendary figure in his own lifetime.

This is not the place to recount the tremendously gripping story of the development of soil conservation as the stay and bulwark of American agriculture, or to appraise Hugh Bennett's influence on this movement. But it can be affirmed that without his canny missionary labors, his forceful leadership, and his persuasive powers before Congressional appropriation committees, there might not be a Soil Conservation Service or a nation-wide system of soil conservation districts, at least in the form in which we know them today. Thus in a very real sense Hugh Bennett is the Father of Soil Conservation.

Born April 15, 1881 in North Carolina, he was graduated from the state university in 1903. Through a Civil Service appointment to the old Bureau of Soils of the U. S. Department of Agriculture, he gained much knowledge of American farm lands by conducting soil surveys, especially in the South. To this reviewer it is highly significent that Hugh Bennett's "first broad-scale appraisal of land from the standpoint of its adaptability to cultivation or forestry" was offered in a paper before a

HUGH BENNETT

forestry audience. The paper was "The Classification of Forest and Farm Lands in the Southern States," presented at the Third Southern Forestry Congress held in Atlanta in 1921. During the 1920's he engaged in a great educational campaign of writing and lecturing on soil erosion.

When in 1933, $5,000,000 in relief funds were allocated to start a program of soil and water conservation in the Department of the Interior, Hugh Bennett was appointed to direct it. Two years later, Public Law 46 made the Soil Conservation Service a permanent agency in the Department of Agriculture, and he moved over from Interior to become the bureau's first chief.

It is a pity that the phrase "a great American" has lost much of its meaning through being applied indiscriminately to all manner of personalities in the public eye, including radio comedians, politicians, baseball players, and itinerant evangelists, as well as to genuinely eminent men. But most readers of this little volume will probably agree that Hugh Bennett is a great American in the highest connotation of the word, and that the good he has done for his native land will long live after him.

HENRY CLEPPER.

Effects of Diverting Sediment-Laden Runoff from Arroyos to Range and Crop Lands.

By D. S. Hubbell and J. L. Gardner. 83 pp. Illus. Superintendent of Documents, Washington 25, D. C. 1950. 25 cents.

The authors of this publication, which is Technical Bulletin 1012 of the U. S. Department of Agriculture, are technicians in the Soil Conservation Service.

Much of the semi-arid Southwest has so suffered from erosion as to represent a serious threat to the economy of the region, and more particularly to the safety of such downstream reservoirs as Lake Mead and Elephant Butte. Sixteen years ago the S. C. S. and the New Mexico Agricultural Experiment Station set up a cooperative experiment of water spreading as a means of conserving flood runoff from arroyos and at the same time controlling sediment movement. Fourteen test sites were selected on the severely eroded 43,000-acre Navajo Experiment Station, tributary to the San Juan River above Shiprock, N. Mex.

Investigations were conducted over the period 1935-1943. Water was spread by plugging arroyos with earthen dams. The proportion of sediment by weight in the runoff ranged from less than 1 to over 60 percent, averaging 13 percent. On the flood plains, sediment deposition just below the spillway averaged more than 2 feet in depth; depth decreased with

distance, becoming negligible at an average of 3,700 feet from the spillway.

Forage production on lightly silted portions of flooded areas was 3 to 9 times that on comparable unflooded areas. The gain on the lightly silted and unsilted portions more than balanced the loss due to damage from sediment, which extended over about 20 percent of each flooded area.

During the 9-year investigative period, 300 acre-feet of sediment, eroded from 9,470 acres, were kept out of Lake Mead by spreading flood runoff over the adjacent valley bottoms.

The study indicates that water spreading, when systematically practiced, can significantly increase the yields of crops such as grain, hay, and forage on thousands of acres in the Southwest and, as important, materially decrease the rapid rates of reservoir siltation.

Specific criteria developed out of this experiment should be of great value in accomplishing rehabilitation of many gullied and bottomland areas now producing no income and constituting a hazard to reservoirs and stream channels.

KENNETH G. REINHART,
U. S. Forest Service.

Growing and Harvesting Tree Crops: A Pulpwood Booklet.

72 pp. Illus. West Virginia Pulp and Paper Company, Covington, Va. 1950. Free.

There are not enough elementary forestry publications like this one. It teaches forestry to the small logger and the small timber owner by showing that it can be practised at a profit when there's a market for thinnings and cull trees as well as for sawlogs. Moreover, the company distributing the booklet provides the market for pulpwood. Thus, through a purely selfish motive the company is promoting forestry. It must buy pulpwood from a large number of private operators and owners, and wants to assure itself of a continuous supply of pulpwood from them. It is therefore to its own interest that these operators and owners know what forestry is; how much of it and how it can be carried out to the mutual advantage of the pulpwood buying company and the producers.

This booklet brings up to date an earlier one published in 1939. The West Virginia Pulp and Paper Company is one of the pioneers in promoting forestry among small owners. In its four pulp and paper plants it uses about 500,000 cords of pulpwood per year.

Beautifully printed on enamel paper and copiously illustrated, the booklet tells the story of what becomes of a tree destined for a paper mill, how the producer's shipment of pulpwood is the first step, and perhaps the simplest, in a complicated chain of highly technical and expensive conversion processes.

There are four parts, all written in simple style. They explain the market for pulpwood; tested methods for cutting and handling pulpwood; business pointers to landowners and producers; and growing trees for future income.

It is obvious that the company is interested in helping the pulpwood producer. If he is a contractor cutting on another's land, he is shown where he can make savings; for example, a simple table shows that his labor costs become exorbitant if he cuts 5-inch trees, 60 of which are required to make one cord of pulpwood, whereas it takes only 7 trees of the 10-inch class. If an owner, he is shown why it should pay him to preserve the small diameter classes for further growth.

Its elementary and readable style assure its use. Its freedom from paternalism and its frankness in giving the company's motives assure it of a friendly reception backed by action.

If distributed among local schools and the public, as it probably is, further good is accomplished by teaching that trees do grow and can do so with profit to everyone whose livelihood is directly or indirectly associated with forest products. Books like this one are a powerful force in building up a well-informed local forest public. It is not the only one of its kind, but it is one of the best.

EMANUEL FRITZ,
University of California.

Northeastern Loggers' Handbook.

By Fred C. Simmons. 164 pp. Illus. Superintendent of Documents, Washington 25, D. C. 1950. 75 cents.

Published by the U. S. Department of Agriculture as Handbook No. 6, this volume was written by a forester on the staff of the Northeastern Forest Experiment Station at Upper Darby, Pa., who has long specialized in logging techniques and the use of machinery and equipment in the harvesting of timber crops.

"The handbook was prepared specifically for young men interested in woods work in the Northeast," Mr. Simmons said, "but it has basic information on logging that will apply nearly anywhere in the country. The products of logging operations are critically important in the current defense effort, and many logging operators are once again starting training programs for new men. The old race of professional loggers is almost gone. Young men interested in woods work have had no source of information as to the tricks of the trade. This book is an attempt to supply this need."

Mr. Simmons explains the fundamentals of logging. He discusses tools, the ax, crosscut saw, bow saw, power saw, wedges, peavies, and other implements. He gives complete instructions for felling, limbing and bucking, skidding and loading. The latest power tools for doing these jobs are described and illustrated. One chapter deals with the construction of all-weather logging roads, another discusses logging trucks.

The handbook places great emphasis on safety because, as the author states, the accident rate in logging is much higher than it should be. The inexperienced woodsman is told how to use and

care for tools, how to avoid injury while felling, skidding, and loading and how to anticipate the hazards of road building.

There is a glossary of woodsmen's terms at the end of the book. It contains more than 300 photographs and drawings.

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Conservation of Natural Resources.

Edited by Guy-Harold Smith. 552 pp. Illus. John Wiley & Sons, Inc., New York. 1950. $6.

This book was written as a college text and should serve the purpose rather well. It is a revised composite volume now representing the contributions of twenty authors. As is usual in such cases, the editor has been ineffective in leveling the objectivity of individual chapters. Thus, the successive changes of tenor with changes of authority outweigh much of the advantage gained by having a group of specialists participate in the preparation of the book. As might be expected, some of the sections are much better than others. For example, the chapter of tree crops, despite capable authorship, is only an imperfect presentation of this important topic. The chapter on soil groups, on the other hand, has very high educational utility.

Foresters will be particularly interested in the two abbreviated chapters relating to forests and their problems. These were both competently written by O. D. Diller. The first of these chapters discusses the character and extent of our forest resource, while the second is devoted to forestry practices as they relate to resource conservation. The only notable lack in this forestry presentation seems to be one of inadequate space. The importance of wood as a raw material and the significance of wood utilization practices have been too drastically restricted. Specific criticism should be made of the use of $35 as a per acre average planting cost figure. The forestry illustrations have been well selected and are of acceptable quality. This is in definite contrast to the pictures in some other portions of the book where they are of unusually small size and of poor quality.

It is interesting to note that much of the frantic exhibitionism that characterized the conservation tests of twenty years ago has disappeared. The effect of resource use on human progress still remains an apparently unconquerable subject. The reviewer feels it would be of educational significance to allocate space in all conservation texts to the impact of world war on natural resources.

This book can unhesitatingly be recommended for adult reading and, when used with carefully selected supplementary material, as a college textbook. It includes a brief discussion of atomic energy and its general relation to the power problem. The reference lists at each chapter ending are usually of commendable scope.

Paul R. Kramer,
Texas Forest Service.

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America's New Frontier, The Mountain West.

By Morris E. Garnsey. 309 pp. Illus. Alfred A. Knopf, Inc., New York. 1950. $3.50.

According to economist Morris E. Garnsey, a professor at the University of Colorado since 1937, the cycle of economic development has again placed the Mountain West at the brink of expansion. Opportunity for resource development in the eight-state region is the new frontier which Garnsey describes.

Population shifts, employment trends, and the present regional production pattern are examined and then compared with those of other regions. America's stake in the Mountain West as well as the contributions the region can make to the nation are also considered before the author gets to an analysis of specific causes of slow industrial development and their remedies.

In spite of tendencies toward large public investments in the development of natural resources of the West and the decentralization of industry, there are certain "institutional barriers" to western development. Two which are given full treatment are the freight rate structure and the basing-point system for pricing. Special interest blocs are also called on the carpet for selfishly hampering regional development. Noted in particular are the silver, livestock, and beet sugar blocs.

Since the conservation of the West's resources is a major point in Garnsey's plan to develop the region, he devotes several pages to an account of the attempt during the past several years of livestock growers' organizations to achieve more benefits for themselves at the public's expense. He quotes, with evident satisfaction, a sentence from an editorial in the October 10, 1949 *Denver Post*, "Some people are going to wonder if the big livestock associations are not more interested in harassing the Forest Service than in range improvement."

Although Dr. Garnsey professes no intimate knowledge of forestry, it is apparent that his reading has given him a general idea of the forestry situation in the Mountain West. Yields of timber alone are not measures of importance, he says, pointing out that watersheds, grazing, wildlife, and recreation are valuable services of forests also. "Forests, water, irrigation, and ranching are knitted together into a single fabric," states Dr. Garnsey, adding that the high degree of integration among the various aspects of the economy is further reinforced when the factor of hydroelectric power is added.

That realization has led Garnsey to recommend coordination of regional developmental activities through research, planning, and the "establishment of regional authorities in several areas of the West."

Included in his twelve-point "program for action" are the extension of soil, forest, and range conservation practices; development of hydroelectric energy and optimum use of water; development of locally managed, locally

financed manufacturing industry to process western food, fiber, and minerals; opposition to institutional barriers and special interest groups; and extension of adequate educational facilities.

Dr. Garnsey views the Mountain West as an economic unit and maintains that if the region itself will do the same its development can be great.

ROBERT D. HOSTETTER,
Society of American Foresters, Washington, D. C.

Commercial Foreign Woods on the American Market.

By David A. Kribs. 264 pp. Illus. Published by the author. State College, Pa. 1950. $6.50.

Dr. Kribs has compiled the essential information on 274 foreign woods, appearing on the North American market, in a manual with identification as its central purpose. The book contains a complete key and is thoroughly illustrated.

The main working parts of the manual are an illustrated glossary, a key to the species, a section in which each species is described in detail, a section of illustrations of the woods, and an index of trade and scientific names. These parts are brought together by references so that identification may begin with the key, follow through a description of the wood, and be completed by comparing the sample with the illustration of the species. If a trade name is available, as is usually the case with commercial samples, the index is the beginning point from which reference is made to the page on which the wood description is found.

The key is of the dichotomous type. It has been tested by several years of use in the tropical wood laboratory at the Pennsylvania State College for adequacy of differentiating characteristics and efficiency as a classroom tool. This key is exceptionally easy to follow.

Illustrations are used freely to clarify the subject matter of the text. Each term of the glossary is accompanied by a photomicrograph in which the anatomical feature under consideration is easily seen. The individual species are represented by figures brought together (without explanatory notes) to form one complete section of the manual. Each figure consists of a photograph of a 10X cross section, an 80X photomicrograph of the cross section, and a 100X photomicrograph of the tangential section.

The author has incorporated the most important references in the bibliography. One hundred and eighteen citations cover the literature well enough for the needs of most students interested in the foreign woods appearing on the North American market.

Each wood described in the manual is in Dr. Krib's wood collection in the form of authenticated hand samples, and permanent microscope slides. Many of these specimens were obtained from well-known wood collections in other countries. The assembling and preparation of this material was, in itself, a big task.

The author, who is recognized as an authority in the field of tropical woods, has presented his subject in a concise, logical form. The manual should become a standard text in the laboratory, and it will undoubtedly be valuable to the lumber industry.

HENRY H. CHISMAN,
The Pennsylvania State College.

Forest Products.

By Nelson C. Brown. 399 pp. Illus. John Wiley & Sons, New York. 1950. $5.

This book is based upon Prof. Brown's previous one in the general utilization field, *Timber Products and Industries.* The descriptive information and the data on the various industries have been brought up to date. It is well illustrated and the data are presented in both tabular and graphic form.

The preparation of a book of this type, essentially encyclopedic in nature, covering a broad field of subject matter, is always a difficult task. It also involves decisions regarding what to include and what to leave out. Prof. Brown has gone about this task in a workmanlike manner and has succeeded in presenting the highlights of a broad and involved field in a readily readable form. The authenticity of the information is evident from the lengthy list of acknowledgments to other authorities who have contributed information and data, and who have reviewed the manuscript.

There are seven general sections, one on economics and general considerations of the utilization field, followed by sections on construction materials, chemically derived products, wood containers, mechanically reduced products, wood as fuel, and miscellaneous products, such as bark, christmas trees, ornamental plants, fruits, etc.

Lumber is not discussed in this book, but the section on construction materials covers general industrial conditions, specifications, and latest developments regarding veneer and plywood, cross-ties, poles and piling, posts and grape stakes, mine timbers, and lath. Wood pulp and its products, naval stores, wood distillation products, extractives, rubber, and maple syrup and sugar are covered in the section on chemically derived products.

The chapter on extractives is especially interesting for it covers tannins, dyestuffs, and such things as cascara, needle oil, mucic acid, and storax. Mucic acid is obtained by hydrolysis of the galactic acid extracted from western larch wood chips. It is used in baking powder, as a substitute for tartaric acid in treating flour, and as an accelerator for the growth of yeast. Storax is a yellowish, fragrant gum exuded by sweetgum. It is used in medicinal preparations, in incense, and in perfume, soaps, and tobacco.

Cooperage, boxes and crates, excelsior, wood flour, stock feed, hardwood dimension stock, and wood densification products are covered and the latest developments outlined. Fuelwood, charcoal, briquettes, and wood gas are discussed in the section on fuel. It is interesting to note that in spite of the great advances and expansion

of the pulp, and the veneer and plywood industries, as well as several others, and the increased use of other fuels such as oil and gas, that fuelwood accounts for 12.6 percent of the total volume of wood cut and still ranks second among the primary wood uses in the country, exceeded only by lumber.

The reviewer finds it hard to let pass a statement such as the one which follows: "Poles and piling are considered best cut during the winter when the sap is down." While it is true that this fallacy is believed by some woods workers, it should not appear in a college textbook and certainly not without explanatory comment to prevent its perpetuation. The author is guilty of occasional "loose" writing and a few too-general statements, but on the whole, the book is a good job. There is a glossary of terms used, and a bibliography arranged by products.

It is a book for the beginner in the field of forest products and for men in other professions, such as engineering, who want a survey of the entire field without too much specific detail on portions of it.

J. Hugo Kraemer,
Purdue University.

The Social Costs of Private Enterprise.

By K. William Kapp. xii + 287 pp. Harvard University Press, Cambridge, Mass. 1950. $4.50.

Foresters will find much of interest in this book, since it deals with a problem of direct concern to them—the identification and evaluation of social costs and returns. "Social costs," as defined by the author, "cover all direct and indirect losses suffered by third persons or the general public as a result of private economic activities." Examples of these costs are presented in considerable detail in twelve chapters. Emphasis is placed both on direct losses resulting from the impairment of human and natural resources, and on more indirect losses arising from technological change, unemployment, monopoly, distribution, and the "frustration of science."

Four chapters of special interest to foresters and other conservationists deal with water pollution and with the depletion and destruction of animal resources, energy resources, soil, and forests. Range lands appear to have been overlooked. "Progressive deforestation" is charged with having raised the cost of timber, left entire industries and whole communities stranded, and seriously impaired the protective function of the forest.

Prof. Kapp also recognizes the existence of "social returns which diffuse themselves throughout society," but leaves their detailed consideration to a separate study. His primary objective in the present work is twofold: (1) to stress the importance of social costs and social returns which do not enter into the calculations of private entrepreneurs, and (2) to urge a reformulation of the classical and neoclassical concept of wealth and productivity so as to include these phenomena within the range of economic analysis. Whether or not the social costs implicit in competitive enterprise are justified as the short-run price paid for economic growth and long-run efficiency, he believes that both social costs and social returns should be evaluated and given due consideration in determining whether the present system is providing "maximum aggregate satisfaction" from the standpoint of society as a whole.

The "new science of political economy," which the author advocates, would regard wealth and production as including all values and utilities irrespective of whether they are exchangeable or not exchangeable, privately appropriable or socially beneficial. He admits the difficulty, and in some cases the impossibility, of placing quantitative values on social costs and returns, and believes that the final determination of their magnitude will depend on the importance which organized society attributes to both the tangible and intangible values involved. The issues raised by this broad approach to "social evaluation" he regards as among the most important unsolved problems of economic science.

The book as a whole is stimulating and provocative. It may easily raise the temperature of those who think it goes either too far or not far enough in implying the desirability of greater public participation in the operation of the economic system. Actually it makes no specific recommendation on this point.

Few foresters will probably disagree with the basic thesis that more attention should be paid to social costs and social returns. They will not, however, receive much help on the two major and exceedingly difficult problems of evaluating these costs and returns, and of determining how they would be affected by public subsidy, regulation, or ownership of resources and industries. The author himself attempts no answers, which he says can emerge only after years of constructive cooperation in the social sciences. The quest is one which is of major interest to those in forestry and related professions, and in which they can and should play an important part.

S. T. Dana,
University of Michigan.

Tree Trails and Hobbies.

By Ruth Cooley Cater. 324 pp. Illus. Doubleday & Company, Inc., Garden City, N. Y. 1950. $3.50.

This inspiring book has opened a new tree trail for me in my own front yard. It is with a 25-year-old Douglas-fir. Like most of the forest trees that have grown high in the home areas of Seattle, this fir of mine has no business here. Ten years ago I sawed six years' growth out of its top. But its growing power seemed only to be stimulated. There it rears again, while it has spread its bottom branches as though trying to be an oak. Their foliage is a green cloud. This is a low and wide curtain against which a long row of rose bushes stands. The fir has its flowering with the blooming of the rose. I'd

never really seen the beauty of this flowering until I came to live with this lone, brave Douglas-fir that stands so far from home in a city street.

So to me one of the most appealing parts of Mrs. Cater's *Tree Trails and Hobbies* is the section headed, "One-by-One Trails." It tells first of a tree in the front yard of a home in Ohio. Some called it a yellow poplar, for the yellow heartwood of other trees of the species. Others called the species white poplar because the sapwood was white. Yet it was unrelated to the poplars. The botany book described a tree with its characteristics under the name, *Liriodendron tulipifera*. Curiosity about the wonderfully flowering tulip-tree led the owner into the trail of a hobby that provided an absorbing, an endlessly growing new interest in life for a middle-aged widow.

Other charming stories of the kind are entitled "The Bald Cypress at the Edge of the Swamp," "The Pinon in the Back Yard," and "The Sycamore by the Creek." They project the simplicity and the appeal of tree study that may readily be started with one tree, especially with a tree that has strong personal interest for the student—as my front-yard Douglas-fir has for me.

This is but one short part of *Tree Trails and Hobbies*. If you wish to be technical about trees—which I don't—you turn, for example, to page 101 and fall into some heavy going on the distinctions between true nuts and false nuts. It says a true nut is "an indehiscent, polycarpellary, 1-seeded fruit, with a woody pericarp, developing from an inferior syncarpous ovary." Mrs. Cater calls this "a rather formidable definition," and hastens to break it down into simple explanations. So I read on. And with the reward of learning that an almond is not a nut but a drupe, (just as I'd always suspected), that the peanut is a legume (*goober pea*), and the Brazil nut a wood capsule (ask the man who's eaten one). I was relieved to read that all acorns are honest nuts. The little essay on just five of the acorns from those of fifty native oak trees has stirred up in me an idea of an acorn collection.

All told, twenty trails are opened and blazed in this highly original tree book. Each had many a surprise turn and novel scene for this old head. There are the "Literary Trails of Truth and Fantasy"—the oak trail through English poetry, the myrtle trail of the Bible, the willow trail of Shakespeare. This section is a ready gold mine for the increasing tribe of oratorical foresters.

"The Main Trail" opens from a scholarly introduction and is divided between "The Conifers" and "The Broadleafs." The "Side Trails for Collectors" has chapters on tree flowers, cones, broadleaf fruits, seeds, leaves, buds, "woody trails" and "fact and fancy." Other sections include chapters on "Name Trails," "Habit Trails" and "Tree Treasure Trails." All are blazed and posted from the personal experience of the author and her husband. Each is well illustrated. Emanuel Fritz and W. D. Hagenstein have assured me that *Tree Trails and Hobbies* is a technically sound book all the way through.

The importance to forestry of this new tree book, it seems to me, is the power it carries to make tree enthusiasts out of readers who have only seen trees heretofore as the forest part of the landscape. It is designed, not to replace standard botany texts, established tree identification books, or such a work as the USDA's monumental *Trees*—but to enthuse its readers into going to the woods with an informed vision and a fresh enjoyment of the *individuals* that form the green glory of our American land.

JAMES STEVENS,
West Coast Lumbermen's Association.

The Climate Near the Ground.

By Rudolph Geiger. A translation and revision by Milroy N. Stewart and others of the second German edition of *Das Klima der bodennahen Luftschicht*. 482 pp. Illus. Harvard Univ. Press, Cambridge, Mass. $5.

The practising forester probably does not regard the regulation of the microclimate as his major weapon in guiding the destiny of the forest. This is not to imply that he has failed to use this valuable weapon, but merely that he has rarely thought of it in those terms.

Geiger is a German professor of meteorology who has spent most of his career in the field with foresters viewing silviculture from his own special standpoint. His observations have been of mutual advantage to both meteorology and forestry. He has looked upon the numerous methods of cutting employed by silviculturists as techniques by which the stand climate was made favorable for enhanced growth of the old trees or the establishment of the new.

In one sense the ideas which he presents are as old as forestry itself; long before the advent of interest in soils, foresters considered regulation of light as the most important tool of silviculture. However, Geiger has gone further and shown how solar radiation, wind, and moisture vary in the forest and play such an important role in its development.

The Blue Hill Meteorological Observatory of Harvard University sponsored the translation of this classic monograph on microclimatology for meteorologists rather than for the exclusive benefit of English-speaking foresters. However, the efforts of the translators will be of distinct usefulness to foresters because almost one-quarter of the book deals with the climates found within stands of vegetation. Foresters will also find much of value in the long sections which describe the effects of topography, snow, water, and various types of soil on the microclimate.

The first section of the book deals with the fundamental physical processes responsible for the microclimate. The treatment of this subject steers away from the mathematical expressions which are dear to the heart of the precise physi-

cist but which often terrify the natural scientist. Anyone with an elementary knowledge of physics and a modicum of intellectual curiosity can extract the information to be found in any chapter.

The book is such a gold-mine of information that one hesitates to point out its faults. The fact that no other book of this nature exists would be ample ground for ignoring almost any criticism. There are some contradictions and certain points are not made clearly. The reader is occasionally left to draw his own conclusions from the data presented. The translation is too literal to make perfect English. Some forestry terms have been mangled in translation; spruce, pine, and fir are used almost at random to refer to various species of conifers. As with all translations, the reader must be on his guard for errors. The reviewer has already found that this book is acceptable but not completely satisfactory as a textbook.

The first German edition was published in 1927, being translated later for limited circulation by John Leighly. The second German edition appeared in 1942, but is now unobtainable because the stock was destroyed during the war. The most recent translation was brought up to date by Prof. Geiger so that it is equivalent to the third German edition which has not yet appeared. The present edition is completely revised and greatly enlarged so that it entirely supersedes the first. The bibliography contains over 800 references, representing an outstanding coverage of the European literature on microclimatology and related subjects.

The sections of the book which deal directly with forestry are concerned more with silviculture than forest protection. The reader will find nothing specifically about forest fires, although much of the fundamental information presented is applicable to problems of fire control. The section on the influence of plant cover on microclimate is the part of the book which is of greatest importance to foresters.

Foresters engaged in silvicultural research will find this book both useful and stimulating. Forest ecologists will find it indispensible, while specialists in forest protection will be interested in the general treatment of the principles of microclimatology. Any forester interested in new ideas about old problems will find the book well worth reading.

David M. Smith,
Yale School of Forestry.

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The Selection of Tree Species.

By Mark L. Anderson. 151 pp. Illus. Oliver & Boyd, Ltd., Edinburgh, Scotland. 1950. 12/6 ($1.75).

This is a good book with a bad title. Unless one happened to know about the author's booklet *The Natural Woodlands of Britain and Ireland*, published in 1932 and now out of print, of which the present book is apparently a revised and enlarged edition, one might think that it dealt with tree breeding or evolution or questions of taxonomy. Actually the first part presents an analysis and classification of available planting sites, based on the author's wide first-hand knowledge, and using plant indicators for the 18 sites he recognizes. The second part gives the requirements and uses of every species that could possibly be used for forest planting in the British Isles. The third part fits the two together, also giving attention to economic considerations.

Obviously, therefore, the title should be "Planting Sites and Selection of Tree Species." Anyone looking through lists of titles for material on site factors and classification would miss this book entirely, and the loss would be serious because the book contains a good deal of valuable material on the subject. The point is one too often overlooked by authors—all the more reason why it should be borne in mind by editors of scientific publications who can easily save research workers an enormous and unnecessary waste of time.

The details in the book are not applicable in America, but the methods and viewpoint are decidedly interesting and valuable. The author says, "We foresters should insist that it is the health and well-being of the forest — embracing more than the trees therein—which are the main objectives of sound forestry. . . ." The book will undoubtedly help to reduce the number of costly failures, and to improve the future forests of the British Isles.

Barrington Moore,
Washington, D. C.

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A Water Policy for the American People.

The Report of the President's Water Resources Policy Commission. Vol. 1, 445 pp. Illus. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. 1950. $3.25.

This report presents the results of the best thinking extant on the status and future requirements of many highly important phases of conservation. Prepared at the request of the President, the report concerns itself with the water resource and the policy by which this resource could best be made to serve the interests of the nation. As the hard-working Commission found, water is no longer plentiful in relation to use; it must be managed and conserved. But, as the Commission also found, more than water is involved. Water resource management is closely associated with land management, for, as the Commission states, "the big streams are fed by small streams, and water control inevitably leads us back to the proper conservation of forests and agricultural land." Recognizing the river basin as the natural unit of water and land, the Commission whole-heartedly endorsed it as the planning unit and the watersheds within the basin as the management units. On this solid foundation of water resource conservation, and water control and land management, integrated through the river basin approach,

the Commission built its report.

After three introductory chapters citing the need and objective of a water policy program, the Commission dived straight into the problems of finance: program and project evaluation, reimbursement by beneficiaries, and public spending. No issues were ducked. Some of their more pointed findings follow: financial feasibility should not alone determine the desirability of a program or project, the federal government develops and conserves resources for the general welfare not for profit; the reimbursement features of programs should be strengthened and expanded, and the tax powers of states and local governments should be utilized to collect from beneficiaries; regularization of resource development expenditures over long periods will do more to stabilize the economy than the currently accepted thesis of priming the pump when the economy sags.

Few realize the magnitude of the contemplated water resource program. The Commission estimates that an adequate national program of water control and use over the next generation would cost in the neighborhood of 100 billion dollars. It cites one recent estimate of 85 billion as total cost, of which watershed management was allotted 11 billion and forest conservation 8 billion dollars.

Next considered were the basic data requirements for river basin planning. To obtain the necessary information the Commission recommended a speeding-up of data collection, including about 50 percent more weather stations, twice the number of streamgaging stations, and four times the present number of daily sediment sampling stations. Also, topographic mapping should be completed in 20 years, geologic and soil surveys in 30 years, and forest and range surveys in 15 years with periodic rechecks every 10 years thereafter.

The remaining two-thirds of the report deals with the various aspects of water and related land management. Foresters will be particularly interested in the chapter on watershed management. Here the latest thinking on how a watershed works is outlined, including a summary, by hydrologic processes, of research results. The work of the various federal land management agencies is also described as well as the relation of western public lands to war supplies. Of interest, in the description of U.S. Forest Service activities and problems, is the Commission's belief that as basin development programs are instituted, incentive payments or credit will be utilized to obtain the cooperation of private forest landowners.

The Commission presents cogent arguments on the necessity of reclamation programs and the benefits inherent in waterway developments. Concerning hydroelectric power, the Commission is of the opinion that the federal government will have to take an increasing responsibility in its development and marketing.

A chapter on conservation education makes some of the finest reading in the report, as much for its presentation of the conservation idea and its growth as for its emphasis on education and civilian participation as an integral part of basin development. The Commission's expression of the conservation-education relation is well worth quoting:

> A national water resources policy should seek nothing short of a gradual revolution in outlook. Education and the conservation movement should become as one. Through conservation, education can create a people which not only guide the necessary governmental action to assure a wise and expanding use of renewable resources, but also act in their daily occupations and recreations in harmony with the highest principles of sustained yield and so achieve permanence as a people.

The Commission was not authorized to deal with questions of organization of a water resource development program. However, its emphasis on the river basin approach obviously suggested that changes must be made in the present organization of water resource activities. Accordingly, the Commission recommended that Congress should direct the principal federal agencies to participate in preparing basin-wide surveys and plans, that organization should be created to coordinate and prepare these plans, and that authorizations and appropriations be made on the basin basis.

Not much can be said on the debit side of the report. In a general acknowledgment of the help received, the Commission stated that its function was principally to bring together the various studies, problems, and recommendations and after thorough-going consideration present recommendations and conclusions. Certainly the best of advice was sought and received. Whether and to what extent recommendations are followed now depends on Congress and the public.

This publication deserves the attention of all foresters. In one sense it is another vindication of one of their most valued concepts—the close relation between forests and water. Ever since the beginning of forestry in this country, foresters have tended to see not only the trees, but also the soil in which they are rooted, and the water which they affect. This report gives further substance to this firmly held and widely accepted concept.

HOWARD W. LULL,
U. S. Forest Service.

Current Literature

Compiled by MARTHA MEELIG, *Librarian, The New York State College of Forestry*

Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

Deciduous Forests of Eastern North America. By E. L. Braun. 596 pp. Illus. Blakiston Co., Philadelphia, Pa. 1950. $10.

Fifty Years of Forestry in the U. S. A. Ed. by R. K. Winters. 385 pp. Illus. Society of American Foresters, Washington 6, D. C. 1950. $4.

The Forester on the Job; Application of Supervisory and Personnel Principles to Forestry Situations. Comp. by W. F. McCulloch. 105 pp. Oregon State College Cooperative Association, Corvallis. 1950. $1.75.

Industry in Action in La Province de Québec. 78 pp. Illus. Canadian Geographical Society, Ottawa, Canada. 1951.

Shantymen & Shantyboys: Songs of the Sailors and Lumbermen. Collected and compiled by William Doerflinger. 374 pp. Macmillan Co., New York 11. 1951. $8.

Southwestern Trees; A Guide to the Native Species of New Mexico and Arizona. By E. L. Little, Jr. 109 pp. U. S. Dept. of Agric., Washington 25, D. C. Agric. Handbook No. 9. 1950. 30 cents (Govt. Print. Off.)

Tree Trails and Hobbies. By R. C. Cater. 352 pp. Illus. Doubleday & Co., Inc., Garden City. 1950. $3.50.

Conservation

A Conservation Land Use Plan for the Town of Wayland, Massachusetts. 15 pp. Massachusetts Forest and Park Association, Boston. 1950. Bul. No. 173.

Farm Forestry

Value of Farm Woodlot Management in Missouri. By P. Y. Burns. 8 pp. Illus. Missouri Agric. Expt. Sta., Columbia. Cir. No. 349 1950.

Forest Management

Applied Forest Management in the Douglas-Fir Region. By P. A. Briegleb. 9 pp. Pacific Northwest Forest and Range Expt. Sta., Portland, Ore. Research Notes. No. 71. 1950. Mimeog.

Forest Products

The Christmas Tree Industry in Canada. By Stanley Besley. 6 pp. Canada Dept. of Resources and Development, Ottawa. 1950.

Growing Christmas Trees in Maryland. By H. W. Dengler. 10 pp. Illus. Univ. of Maryland Ext. Serv., College Park. 1950. Mimeog.

Forest Resources

The Nation's Wood Supply. 22 pp. Illus. American Forest Products Industries, Washington 6, D. C. 1951.

Logging and Milling

Portable Chippers; Data on the Utilization of Sawmill Reject Material and Initial Trials of the Carthage Portable Chipper. 13 pp. Illus. Northeast Pulpwood Research Center, Gorham, N. H. 1951. Mimeog.

The Sandy Hill Peppy Peeler. 12 pp. Illus. Northeast Pulpwood Research Center, Gorham, N. H. 1951. Mimeog.

Protection

Getting Fire Losses Under Control. 8 pp. West Virginia Pulp & Paper Co. From The Forest Farmer, October, 1950.

Range Management

Ecology of Mixed Prairie in Canada. By R. T. Coupland. Ecological Monographs, Duke Univ. Press, Durham, N. C. Vol. 20, pp. 271-315. Illus. October, 1950.

Forage Plants of the Meadows and Pastures of U.S.S.R. Vol. I. (In Russian.) 687 pp. Illus. Moscow, Govt. Printing Off. of Agricultural Literature, 1950.

An Introductory Bibliography of Range Management in Wyoming. By A. A. Beetle. 12 pp. Wyoming Range Mangt., Univ. of Wyoming, Laramie. No. 27. September, 1950. Mimeog.

Preliminary Guide to Reseeding Pinyon-Juniper Lands of Western Colorado. By A. C. Hull and C. W. Doran. 16 pp. Illus. U. S. Forest Serv., Rocky Mtn. Forest & Range Expt. Sta., Fort Collins, Colo. Sta. Paper No. 4. December, 1950.

A Rancher's Viewpoint. By J. L. Budd. 5 pp. Wyoming Range Mangt., Univ. of Wyoming, Laramie. No. 31. January, 1951. Mimeog.

A Review of Utah's Big Game, Livestock, and Range Relationship Problems. 53 pp. U. S. Forest Serv., Intermtn. Forest & Range Expt. Sta., Ogden, Utah. Research Paper No. 24. September, 1950. Mimeog.

Silviculture

Financial Aspects of Pruning. 45 pp. Illus. Pacific Northwest Forest and Range Expt. Sta., Portland, Ore. 1950.

Reforestation Research Findings in Northern Wisconsin and Upper Michigan. By J. H. Stoeckeler and G. A. Limstrom. 34 pp. Lake States Forest Expt. Sta., St. Paul 1, Minn. Sta. Paper No. 23 1950. Mimeog.

Seed Maturity in Douglas Fir. By J. M. Finnis. 4 pp. Charts. British Columbia Forest Serv., Victoria. Research Notes No. 18. 1950.

Subericultura. By J. V. Natividade. 387 pp. Illus. Ministério da Economia. Dos Serviços Florestais e Aquícolas, Lisbon, Portugal. 1950.

Soil Conservation

Soil Conservation in Indiana. By R. O. Cole. 27 pp. Illus. Purdue Univ. Agric. Ext. Serv., Lafayette, Ind. Ext. Bul. No. 228. 1950.

Weeds, Guardians of the Soil. By J. A. Cocannouer. 179 pp. Illus. Devin-Adair, New York 10. 1951. $2.75.

Soils

A Guide for Forest Soil Examination in the Douglas-Fir Region. 32 pp. Pacific Northwest Forest and Range Expt. Sta., Portland, Ore. rev. 1950.

Wildlife Management

Bear River, a National Wildlife Refuge. 13 pp. Illus. U. S. Fish & Wildlife Serv., Washington 25, D. C. Conservation in Action No. 8. 1950.

National Wildlife and Conservation Digest (a monthly magazine beginning Jan. 1950). Pike and Kearne, 184 Lanark St., Winnipeg, Manitoba. $3 per yr.

Wood Technology and Utilization

Hardi-Floor, a Vertical Wood Block Flooring. 15 pp. Illus. Purdue Univ. Agric. Expt. Sta., Lafayette, Ind. Sta. Cir. No. 363. 1950.

Importance of Dry Lumber. By R. C. Rietz. 7 pp. U. S. Forest Products Lab., Madison, Wis. R1779. 1950. Mimeog.

The Utilization of No. 3 Douglas-Fir Lumber for Prefabricated Panels. By M. D. Macdonald. 31 pp. Illus. Oregon Forest Products Lab., Corvallis. Info. Cir. No. 5. 1950.

The Utilization of South African Grown Eucalyptus Saligna. By M. H. Scott. 15 pp. Govt. Printer, Pretoria, U. of S. A. Bul. No. 34. 1950. 3d.

Where to Use Douglas Fir Lumber. 16 pp. Illus. West Coast Lumbermen's Assoc. Portland 5, Ore. 1950.

Society Affairs

Compiled by ROBERT D. HOSTETTER, *Assistant Executive Secretary*

Officers and Members of the Council, 1950-1951

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International Paper Company
Mobile 9, Ala.

Nominating Procedure Outlined for Election

A president, vice president, and nine Council members will be elected December 1, 1951. Their term of office will be for the two-year period 1952-1953. The Constitution provides that they must be Members (formerly Senior Members) or Fellows.

The present officers and Council members whose term of office expires December 31, 1951 are listed in the box above. They are eligible for renomination provided they give their consent in writing to serve if elected.

However, both President Evans and Vice President Herr have announced that they will not be candidates for reelection.

Procedure

President and vice president. There must be at least two candidates for the office of president; preferably more, so as to provide a contest. All candidates for president are considered as nominated also for vice president. The candidate receiving the highest vote is declared elected president. The candidate receiving the next highest vote is declared elected vice president.

Members of the Council. There must be at least nine candidates for the Council; preferably more, so as to provide contests.

Nominating procedure. Nominations for officers and members of the Council are made by petition. If a sufficient number of nominations are not made by petition, additional selections will be made by the Nominating Committee.

Nominating petitions are subject to the following conditions.

1. Each petition shall name but one candidate.

2. All candidates must be eligible to hold elective office; that is, they must be Members or Fellows in good standing.

3. Each petition must be signed by ten voting members (Junior Members, Members, and Fellows) who at the time of signing the petition are eligible to vote in the coming election.

4. A voting member may sign one nominating petition for president and one for member of the Council. (In other words, he may sign two, but no more.)

5. Petitions must be received in the Society's office in Washington, D. C. on or before October 8, 1951.

6. No nomination is valid until the nominee accepts the nomination in writing and agrees to serve if elected. Petitioners should obtain the written consent of the candidate in advance and submit it with the petition.

Form of petition. An acceptable form of nominating petition is as follows:

We, the undersigned voting members of the Society of American Foresters, hereby nominate ———— to the office of president (or member of the Council) for the regular biennial election of 1951.

Nominating Committee

President Evans with the approval of the Council has authorized the following Nominating Committee to serve for this election.

Chairman, Alf Z. Nelson, R.F.D., New Ipswich, N. H.

William C. Postle, Box 351, Winnfield, La.

Everett L. Hamilton, U. S. Forest Service, Glendora, Calif.

Alex J. Yorman, Box 83, Solon Springs, Wis.

Vincent Bousquet, Box 133, Centralia, Wash.

This committee will make no nominations of its own unless the members at large fail to make a sufficient number to meet Constitutional requirements. It is up to the members to decide whether they want to select their own candidates by petition, or have them hand picked by a small committee.

Certainly, nominations made by petition are the more democratic way. Hence, members are urged to get busy and choose the men they want to run their Society, and do it promptly.

The executive secretary will gladly be of assistance to any members who desire assistance or need additional information.

ALF Z. NELSON, *Chairman,*
Nominating Committee.

Approved Curricula Discussion Reopened

Following the Council's reaffirmation, during the December 13-16, 1950 meeting of the Society, of its previous establishment of a list of specified courses which must be included for a forestry curriculum to be approved, an exchange of correspondence resulted which is published here for the information of Society members.

Such a list of required courses was first established by the Council in December 1948 in order to determine which graduates of institutions accredited to offer professional forestry education were eligible for Junior Membership in the Society. (See pages 151, 152 in February 1949 JOURNAL OF FORESTRY). Subsequently, with the cooperation of the heads of the accredited forestry schools, a list of curricula approved and not approved was compiled and issued to the Council, the Committee on Accrediting, officers of the Division of Education, and to the heads of all accredited forestry schools on June 6, 1949.

In October 1949, the Council designated the number of semester units that were to constitute each of the required courses. (See pages 1008, 1009, in the December 1949 JOURNAL OF FORESTRY). That information has been printed on all membership forms since then.

As part of the Council's assignment to the Committee on Accrediting, the Committee was asked to report to the Council at its December 13-16, 1950 meeting regarding which curricula at accredited forestry schools did and did not qualify graduates for Junior Membership in the Society. The Committee's report was published on pages 143 and 144 of the February 1950 JOURNAL OF FORESTRY. The Committee was governed by the following list of required courses in determining which curricula did and did not qualify graduates for Junior Membership:

To be approved, a curriculum must contain the following five, basic professional courses:

1. Silviculture. (Must include 3 semester units of ecology; 6 semester units of botany, plant physiology, and dendrology; 3 semester units of soils; and 3 semester units of silviculture.)

2. Protection. (Must include 3 semester units of fire, insect, or disease protection.)

3. Management. (Must include 3 semester units of mensuration; 3 semester units of surveying; mathematics through trigonometry; and 3 semester units of forest management.)

4. Economics. (Must include 3 semester units of general economics; and 3 semester units of forest economics.)

5. Utilization. (Must include 3 semester units of utilization.)

On January 8, 1951 Henry Clepper sent a memorandum which contained the information published in the February JOURNAL to the heads of all accredited forestry schools. It was to that memorandum that Dr. R. J. Preston referred in the following letter to President Charles F. Evans:

January 22, 1951

DEAR MR. EVANS:

I have just received the memorandum from Henry Clepper dated January 8 on the subject: "Eligibility for Junior Membership in Society of American Foresters." Frankly, I am appalled. If I total correctly, there are more curricula taught by forestry schools which do not qualify than which do qualify. (Editor's note: 41 curricula are approved: 34 curricula are not approved.) I have long felt that the Society was making a serious mistake in setting up such strict requirements for membership, but it took this memorandum to make me realize how very serious the results are.

Fifteen of the twenty-five accredited schools now have one or more curricula which do not meet requirements. Surely each of these schools is striving to retain a feeling of unity and common interest among the student body. This Society-imposed segregation of the sheep from the goats is going to make a high esprit de corps within the student body more difficult and I wonder if, consciously or unconsciously, the faculties of the school are going to take less interest in promoting the Society to the students and graduates when such promotion will tend to further divide the student body.

Last December in Washington the feeling against our present strict membership requirements was pretty strong. The majority of the members on the Committee on Accrediting felt strongly that there should be revision and the Council of Forestry School Executives passed a motion that they favored liberalizing the requirements for membership as set up by the Council.

Might I suggest that the Council give serious consideration to adopting the proposals which J. Lee Deen set forth to the Accrediting Committee. These would appear to amply safeguard membership requirements and many of the curricula in the unqualified group would qualify under these proposals. Also, many others could be made to qualify with minor changes. For our part we would like our wood technologists to be accepted and would attempt to alter our curriculum, if such alteration were possible without destroying our educational goals.

I am taking the liberty of sending copies of this letter to the members of the Council, the Accrediting Committee and the Forestry School Executives.

Sincerely,
R. J. PRESTON, Dean
North Carolina State College
School of Forestry

EDITOR'S NOTE: Dr. J. Lee Deen, dean of the School of Forestry and Range Management at Colorado A & M College on November 14, 1950 proposed the following optional requirements for approved curricula in accredited forestry schools:

Option I

Eligibility requirements as now set up and appearing in December 1949 Journal of Forestry on page 1009. Makes possible an eligible curriculum designed for a minimum of required forestry subjects. It insures that this minimum be properly distributed. Under this option it is possible for a student to graduate with not more than 20 required semester units or 30 required quarter credits in forestry.

Option II

A curriculum requiring a minimum of 30 semester credit hours or 45 quarter credits in forestry subjects at the upper division (junior-senior) level. Forestry subjects are those taught by a forestry school faculty and described as such in a college or university catalog. Option II makes possible an eligible curriculum of specialization in one field of forestry, especially forest products or utilization.

Option III

A curriculum requiring a minimum of four out of five of the subjects and credit hours as listed below. In addition, a curriculum must require sufficient credit hours of subjects taught by a forestry school faculty to bring the total of required upper division (junior-senior) subjects to 30 semester or 45 quarter credit hours. They may be range management or any other subjects in forestry and allied fields taught by a forestry faculty.

Subject	*Semester hours*	*Quarter hours*
Silviculture	2	3
Forest protection	2	3
Forest management	2	3
Forest economics	2	3
Forest utilization	2	3

Option III makes possible an eligible curriculum of specialization in one of the fields closely allied to forest management, such as range management.

President Evans replied to Dr. Preston's letter as follows:

January 25, 1951

DEAR DR. PRESTON:

I was greatly surprised on reading your letter of January 22 to learn that you object so vigorously to the eligibility standards used in determining whether the various curricula qualify graduates for membership in the Society upon graduation. You are not a newcomer in the academic field so I cannot understand why this hit you so hard only after the Accrediting Committee finished its work.

The subject of membership standards was before the Council in 1947 and 1948. Every effort was made by President Martin and other officers of the Society to get the subject widely and thoroughly discussed by the members. The JOURNAL carried everything that anyone wished to contribute on the subject. The schools were consulted and I thought they did much to guide the Council. Finally after more than a year of discussion and deliberation the referendum was submitted and was approved by the members.

You will recall that it was the range management men who at that time were pressing for a more liberal policy. As far as I can recall the products men did not urge liberalization. Do you not think it a little late to make such violent objection? Please do not misunderstand me. Any subject of importance to a member or a group of members will always be open for consideration or reconsideration. I promise you that it will be brought up for consideration at the Council meeting in June. But no early action could possibly be taken. Another referendum would be required and it should be preceded by an adequate period of discussion by the membership. I have not yet seen J. Lee Deen's proposal and it may be it could be approved by the Council without a referendum decision.

I wish you and I could have talked this over when we were together that week in November. Maybe we could not have agreed but I could have given you my viewpoint better than I can in a letter. I think it is not unfair to require a man to complete a curricula containing all the required courses, silviculture, protection, management, economics and utilization. Admittedly he can do that and not be a qualified products man but I insist that with anything less he will not be a qualified forester. You may say that my definition of a forester is too narrow and restrictive. My dear Doctor! The term is almost meaningless to the public now and if I could achieve my ambition the next generation of my fellows would have an identity like doctors, engineers, and other professional men have. Of one thing I am very sure. We shall not accomplish that by broadening the base to include men who do not study much forestry in school and who have no intention of practicing it after they are graduated.

But, after all I do not decide these matters. I only represent those who do and I shall make sure that your viewpoint is given thoughtful consideration.

Very sincerely yours,
C. F. EVANS, President
Society of American Foresters

Myron Kruger, Chairman of the Society's Committee on Accrediting, wrote the following letter to President Evans on January 29, 1951:

January 29, 1951

DEAR MR. EVANS:

Reference is made to Dr. R. J. Preston's letter of January 22. I do not go along with Dr. Preston in being "appalled" by the present situation as regards forestry curricula. I look upon it as a perfectly natural situation. It merely means that we have now moved to the point where subject matter which was formerly confined to adjunctive courses in the forestry curriculum has now expanded into two or three specialized curricula. Because of this the graduates of these curricula are fully justified in having their own professional societies.

The whole subject needs much more discussion than it has received up to the present. I am sure that a great many members of the Society do not realize fully the step we were taking when we made the proposal we did at the meeting of the Society in Boston in 1948. I hope this discussion will take place but I think we need to keep the discussion on a very calm level and allow a few years to see whether the present plan will work.

I have looked over J. Lee Deen's proposal again and I am not in agreement with it. I believe his proposal rests upon a faulty approach. I am convinced that the development of specialized curricula should start with the clear-cut proposal to develop the programs according to the need in a given specialized field and should have no bearing on qualifications for the Society of American Foresters or any other professional societies. Of course if Dr. Deen and Dr. Preston merely want to bring out that we are in a transition period and therefore should attempt to make the transition in easy stages, I am inclined to be sympathetic to that viewpoint.

Perhaps a good start on the discussion would be for you to publish Dick Preston's letter in the JOURNAL, if he is agreeable. That will give others the opportunity of replying. With kindest personal regards, I am

Cordially yours,
MYRON KRUEGER, Chairman
Accrediting Committee

Two other pertinent letters, one addressed to President Evans and one addressed to Dr. Preston are also published below:

February 8, 1951

DEAR MR. EVANS:

After studying the copy of the letter to you from my good friend and neighbor, Dr. Preston, I feel that you should have a reaction from the other "camp." This is one of the very few issues on which I happen to disagree with Dr. Preston.

It is true that the Council of Forestry School Executives passed a motion favoring liberalizing the requirements for membership in the Society but it was not by an overwhelming majority as one might possibly infer from his letter to you. At the discussion of this matter in Washington, I made the point that if a school so desired they could shape their curricula so that the men graduating from the sideline curricula can still be eligible for membership in the S.A.F. This is exactly what we did at Duke when we set up our new curriculum in forest products for we anticipated that we would like to have our men eligible for membership in the Society if they so desired. I submit that it should be possible to bring a number of curricula into line if the respective administrative heads are really sympathetic toward maintaining a forestry profession as distinct from an aggregation of all sorts of borderline fields.

I seriously doubt if this question can ever be settled to the complete satisfaction of all members of the S.A.F. even though many of us are satisfied with the present situation.

In refreshing my memory, from the minutes of the annual meeting of the Council of Forestry School Executives the Council not only went on record as favoring liberalizing the S.A.F. membership requirements but also passed a motion that a committee be appointed to study the question of liberalizing the requirements for membership and report at next year's meeting of this group. I would suggest, therefore, that further discussion and consideration of this matter as proposed by Dr. Preston be delayed until after the Executives' Committee has rendered its report at our next year's meeting and our Council has had a chance thoroughly to digest it. I believe we will find that many members of the Society are strongly desirous of seeing a strong professional society made up of technically trained foresters. Dr. Preston will, I am sure, recall that this was very strongly brought out by several speakers at the business session of the Appalachian Section of the S.A.F. on January 27 in connection with a discussion of membership requirements.

I, too, am taking the liberty of sending copies of this letter to members of the S.A.F. Council, the Accrediting Committee and the members of the Council of Forestry School Executives.

Sincerely yours,
C. F. KORSTIAN, Dean
School of Forestry
Duke University

January 25, 1951

DEAR DR. PRESTON:

While you can't hear it, I am applauding heartily your letter of January 22nd to the President of the Society of American Foresters.

However, the two problems, (1) the accrediting of forestry curricula and, (2) membership in the Society of American Foresters, may be viewed as distinct and separable. I think it logical for the Society to accredit a professional curriculum and still admit men from non-accredited curricula to membership in the Society.

In the first case, the Society is endeavoring to make available to the prospective forestry student and to the administrative authorities of the universities offering forestry training unbiased information as to whether a specific curricula of a specific school will train men competent to practice "forestry." Now here let me define "forestry" as I see it: Men with the basic training and professional knowledge that will enable them to manage efficiently a forest property for wood production and, incidentally, for other uses and services that such forests should render.

It is appreciated that my concept of the *future* of the forestry profession differs materially from the concept which has been held, and still is being held, by the vast majority of the foresters today. I do not believe that a man is a forester if his primary function is to manage a piece of forest land for recreation, wildlife production, or even water-shed protection. Obviously then, I also would not consider a man as practicing the forestry profession who does not manage forest land, such as the range manager, the municipal forester or the man employed mainly in the extraction, fabrication and distribution of wood or other forest products.

My reason for reaching this unpopular decision is simply that the work to be performed in natural resources management and the college training necessary to perform it efficiently differ radically for each of the specialties mentioned in the preceding paragraph. Such training, even now, cannot be encompassed in one curriculum. As times goes on and we obtain from research and experience an increasing body of knowledge in reference to our renewable natural resources, their management and processing, men to compete for and retain positions in any of the lines of activity (professions if you must) mentioned above, will have to study those basic concepts and that specialized knowledge which gives them greatest competency to carry on the work required of them. So courses of instruction must, of necessity, continue to diverge more and more, or the period of college training progressively lengthened.

Now which of these groups of professional workers in the renewable natural resources should be eligible for membership in the Society of American Foresters? Once I had hoped that the Society of American Foresters might remain a broad organization including all of the workers in the renewable natural resources other than agriculture. It would satisfy the divergent interest of its members through separate subject matter divisions. So I was disappointed when the Wildlife Society was organized, even though I am a charter member. However, since then I have accepted the viewpoint that, despite the establishment of many subject matter Divisions, no one society can ever fulfill, in the future, the professional interests in this broad field of human knowledge and professional endeavor. So I view as logical, the establishment of the Range Society, the Soil Conservation Society, and the Forest Products Research Society. This is not the end, there will be more.

Nevertheless, there will always be men interested in maintaining membership in more than one professional society, the most important reason being that there will always be many positions on the border line between distinct fields. Men, for example, may give half time to recreational management and half time to wood production. The danger that professional standards will be lowered and that the Society will support unsound forest policies is nonexistent, even if everyone could qualify for membership, because the bulk of the membership will always consist of those who are foresters as previously defined. Most of the men in allied fields such as wildlife, forest products, soil conservation, etc. will join their own professional society and will not be sufficiently interested to pay higher dues in yet a second professional society.

Sincerely yours,
PAUL A. HERBERT, Director
Division of Conservation
Michigan State College

Allegheny Meeting Features Photos

Around 120 members and guests of the Allegheny Section, attended its 29th annual winter meeting held in Baltimore, Md. on February 15, 16, and 17, 1951.

Features of the meeting included motion pictures on the activities of the Interstate Commission on the Delaware River, slides on forestry in Bolivia, and displays of aerial photographic equipment.

Panel discussions centered around the use of aerial photographs in forestry, and on problems of watershed management. An illustrated discussion of oak wilt was presented by Marvin Fowler, pathologist, Agricultural Research Administration.

At the annual banquet, Dr. Carl C. Taylor, Bureau of Agricultural Economics, talked on "Conservation—A Social and Moral Problem."

New Section officers elected at the meeting are; Maurice K. Goddard, chairman, Pennsylvania State Forest School, Mont Alto, Pa.; D. E. Hess, vice chairman, Gladfelter Pulpwood Co., Murphy Bldg., Gettysburg, Pa.; J. Howard Mendenhall, secretary-treasurer, 405 F & M Bldg., West Chester, Pa. Additional members of the executive committee are Torkel Holsoe and Gordon G. Mark.

Draft Gets Two; Miller Remainder

Two of the February class of forestry graduates at Purdue University traded their sheepskins for military draft "greetings." The other 23 graduates submitted their applications for Junior Membership in the Society of American Foresters.

Charles I. Miller is the Central State Section's representative at Purdue and also serves as the Indiana member of the Section's membership committee.

Puget Sound Section Urges Passage of Bill

At its February 2 meeting, the Puget Sound Section unanimously passed a resolution urging the passage of Senate Bill 107 by the Washington State Legislature. The bill provides for the cooperative control of forest insects and diseases under the supervision of the State Forest Board. Insect control districts would be established as would an insect and disease control fund. The bill provides for private land owner participation up to a maximum of 25 percent of the cost of control action. The state would contribute, on private lands, 50 percent of the cost, and the federal government, 25 percent.

Bernard L. Orell, supervisor, Division of Forestry, State of Washington, discussed Senate Bill 107 and other pending legislation.

Marc Burdick of the Linscott Manufacturing Company, Centralia, Wash., spoke on the subject of manufacturing finished products from mill residuals and salvaged timber. Products manufactured by his company include venitian blind rails, slats, and facia boards; striated shakes; spindles for cribs, clothes racks, and toys; drawer slides; dowels; and window shade slats.

During a business session the Section's policy committee recommended a comprehensive study of the state land management problem. Jim Stevens also reported on the publicity committee's weekly forestry radio programs.

Columbia River Group Has Varied Programs

William B. Greeley, in speaking on "Forests in National Defense" at the December meeting of the Columbia River Section, declared that World War II "launched us on a great upswing in industrial forestry, in the growth of our woodlands, in the reduction of wastes, and the know-how of wood use."

The sale of public timber was the subject of a panel discussion at the February meeting. In March, the group learned more about the Oregon Forest Products Laboratory and the Washington Institute of Forest Products.

A meeting in conjunction with the American Society of Range Management was held on April 2, and the May meeting will be a field trip to Crown Zellerbach Corporation's Clackamas Tree Farm.

New officers are to be installed in June.

Iowans Recommend Forestry Program

"To promote the science, practice, and standards of forestry in America" is the third object of the Society, and the Iowa Chapter of the Upper Mississippi Valley Section has initiated a project for the fulfillment of that object. *A Recommended Forestry Program for Iowa* is a 24-page, printed report prepared by the Iowa Chapter in December 1950. The booklet was published through the cooperation of the Iowa Division of the Izaak Walton League of America.

The recommended program is based on a study of the present forestry situation and of measures which will improve the forestry practices and programs. As well as recommending a forestry program, the Iowa Chapter recommends specific legislation to aid in the achievement of the objectives.

The forestry program objectives are outlined in brief in the following quotation from the publication.

"Iowa's forestry program should be aimed at (1) securing full recognition of the value and importance of the woodlands to Iowa's social, agricultural, and industrial economy; (2) the best use and perpetuation of all native and planted timberland and woodlands on public and private lands; (3) reduction in grazing or pasturing of the woodlands; (4) full utilization of the forest crop; (5) adequate woodland fire protection; (6) adequate protection from diseases and insects; (7) the establishment of farmstead and feedlot windbreaks, and field shelterbelts on private lands; (8) the forestation of public and private lands; (9) adequate forestry research in all phases of silviculture, management, protection and utilization; (10) multiple use of the State Forests with major emphasis on using them to demonstrate the value of woodlands and plantations in producing forest crops and in conservation of soil and water; (11) providing limited areas of woodland-reserves as examples of natural tree growth and for their historical interest; (12) a strong education and demonstration program in all phases of forestry."

Operations on forest land under all types of ownership are considered in some detail, with recommendations for better forestry practices included. The relationships between forestry and soil and water conservation, flood control, wildlife, and recreation are also emphasized.

Washingtonians Study Water Policy Report

At its January 25th meeting, the Washington Section heard a first-hand account of the President's Water Policy Commission report from E. N. Munns, chief of the Division of Forest Influences, U. S. Forest Service. Mr. Munns acted as consultant on watershed problems for the Commission. After reviewing the evolution of water development programs in the United States, he described the purposes of the Commission and evaluated Volume I of its projected three-volume report. Volume I is already off the press. It deals with policy and contains the Commission's recommendations for national water resource development. Mr. Munns' personal opinion of the report is that it stands as a great monument to factual presentation and analysis, but is too fraught with compromise in policy matters to be effective.

In preparing the reports, the Commission obtained and analyzed data from 750 public and private agencies including the Society of American Foresters, the 48 states, and from many universities and colleges. Eight public hearings were held.

Ozark Section Approves Inter-Agency Action

Land management, with emphasis on the water resources of the Arkansas-White-Red River basins, was the principal subject considered by the Ozark Section at its winter meeting on January 26 and 27, 1951 at Springfield, Mo.

The Section passed a resolution which approved the inter-agency approach in planning for the use of water on major drainages and recommended that the action program should be organized on the same coordinated basis.

Other resolutions favored further publicity and encouragement in pasture improvement and a land survey of Ozark Section states to facilitate better land use management.

After viewing the movie "The River" at its initial session, the Section heard talks by H. H. Krusekopf, Edward L. Clark, and John Short on subjects relating to water management. Professor Krusekopf of the University of Missouri described the relations between Ozark soils and water management and the part that foresters can play in developing maximum water values. Dr. Clark, Missouri state geologist, emphasized the necessity for recharging underground water sup-

plies and efficiently using existing water resources. Mr. Short told of his work as field representative for the Department of Agriculture in coordinating activities of governmental agencies in the Arkansas-White-Red River basins. Representatives of nine agencies of the Department of Agriculture form a field committee whose recommendations are coordinated with those of thirteen other governmental agencies to form a land use program.

Speakers at the banquet program were C. C. Walliford, U. S. weather forecaster, and Dr. Meador of Drury College, Springfield, who gave a resume of present world conditions and an analysis of communism.

Officers elected to serve during the ensuing year are: Chairman, Nat Walker, 334 Admiral Road, Stillwater, Okla.; Vice Chairman, Gordon D. Hartrick, Fountain Hill, Ark.; and Secretary-Treasurer, Peter W. Fletcher, 1506 Rosemary Lane, Columbia, Mo. Hamlin L. Williston, Crossett, Ark., will continue as membership chairman.

Chapter Notes

Guerdon Dimmick gave an illustrated presentation of forest fire equipment development at a dinner meeting of the Milwaukee Chapter of the Wisconsin-Upper Michigan Section on February 11.

Officers for 1951 of the Southeast Arkansas Chapter, Ozark Section are Charles Grano, Frank Grote, Ralph Law, and Donald Tufts. Barbecued chicken and sawmill efficiency were principal subjects considered at a visit to the Ozan Lumber Company last December.

At the January Coushatta meeting of the North Louisiana group of foresters, the new Louisiana Tree Farms System was a principal subject of discussion. A proposed manual of procedures and requirements has been written by the state tree farms committee composed of George B. Cunningham, Bertram A. Ryan, Lloyd P. Blackwell, with Louisiana State Forester James E. Mixon and Southern Pine Association Forester William C. Hammerle as advisers. All are Society members.

Candidates for Membership

Candidates for membership whose applications were received in the Society office prior to March 1, 1951 are listed below. Names, positions, addresses, and education are given.

Action regarding the eligibility of these candidates will be taken by the Council as of May 1, 1951. Comments, protests, or important information regarding the qualifications for membership of candidates listed are invited from present voting members. All such communications are kept strictly confidential, being used only by the Council in taking final action on applications. Correspondence should be received in the Society office prior to May 1, 1951.

The names of those candidates who are elected will be published in the Society Affairs department of the June 1951 JOURNAL OF FORESTRY. The names of those who signify their acceptance of election will be published in subsequent issues of the JOURNAL.

Appalachian Section

Junior Grade

Allan, K. M., Grad. Student, Duke Univ., Durham, N. C.; Univ. of Mich., B.S.F., 1929. Reinstatement

Mathews, W. G., Jr., 907 Broad St., Altavista, Va.; V.P.I., B.S., (Forestry), 1949; Univ. of Mich., M.F., 1951.

Rhyne, T. S., Jr., Farm Forester, Dept. of Cons., Whiteville, N. C.; N. C. State, B.S.F., 1949.

Member Grade

Gallup, J. A., Dist. Forester, Int. Paper Co., Winnsboro, S. C.; Pa. State, B.S.F., 1942. (Junior, 1948).

Marbut, S. A., Ext. Forester, Clemson College Ext. Service, Clemson, S. C.; Univ. of Ga., B.S.F., 1939. (Junior 1947).

White, N. M., Asst. Mgr., N. C. Pulp Co., Plymouth, N. C. (Junior, 1947).

Central States Section

Junior Grade

Brendemuehl, R. H., 204 S. Salisbury St., Lafayette, Ind.; Univ. of Minn., B.S.F., 1950.

Buell, D. L., Forester, Patten Logging Co., Amasa, Mich.; Univ. of Mich., B.S.F., 1946; M.F., 1947.

Curtin, T. W., 615 Jefferson St., Beardstown, Ill.; Purdue, B.S.F., 1951.

Crankshaw, W. B., 1635 Franklin Ave., Ft. Wayne, Ind.; Purdue, B.S.F., 1951.

Eloff, J., 5110 Maryland St., Gary, Ind.; Purdue, B.S.F., 1951.

Foley, T. A., Box 336, Paris, Ill.; Purdue, B.S.F., 1951.

Fyffe, W. E., 1110 E. Van Trees St., Washington, Ind.; Purdue, B.S.F., 1951.

Green, E. J., Jr., Park Rgr., Mich. Dept. of Cons., Chelsea, Mich. Univ. of Mich. B.S.F. 1950.

Groncki, A. R., Lab. Asst., Univ. of Mich., Ann Arbor, Mich.; Univ. of Mich.; B.S.F., 1947; M.F., 1951.

Hamann, R. E., 1307 Howell St., Lafayette, Ind.; Purdue, B.S.F., 1951.

Harper, R. M., 356 3rd St., Manistee, Mich.; Mich. State, B.S.F., 1924. Reinstatement.

Harris, C. G., Chief, Survey Party, City Engr., Lafayette, Ind.; Purdue, B.S.F., 1951.

Hassler, M. G., 248 E. Market St., Spencer, Ind.; Purdue, B.S.F., 1951.

Hebble, K. A., Box 99, Thornton, Ill.; Purdue, B.S.F., 1951.

Hess, J. C., 1249 Oakdale Drive, Ft. Wayne, Ind.; Purdue, B.S.F., 1951.

Hill, R. M., 2221 N. 20th St., Lafayette, Ind.; Purdue, B.S.F., 1951.

Hoffman, W. H., 811 N. Court St., Crown Point, Ind.; Purdue, B.S.F., 1951.

Hoover, D. B., 403 Arbana Drive, Ann Arbor, Mich.; Univ. of Mich., B.S.F., 1951.

Huffman, C. E., 365 Hower St., North Canton, Ohio; Purdue, B.S.F., 1951.

Johnson, W. P., 502 N. Clark St., Nappanee, Ind.; Purdue, B.S.F., 1951.

Kiefer, J., Iroqois 1, W. Lafayette, Ind.; Purdue, B.S.F., 1951.

Leland, F. C., 4612 N. Keating Ave., Chicago, Ill.; Purdue, B.S.F., 1951.

Mayrand, E. J., R.F.D. No. 1, Corunna, Mich.; Mich. State, B.S.F., 1950.

McCoy, E. W., Shady Rest Trailer Park, Lafayette, Ind.; Purdue, B.S.F., 1950.

Nye, J. W., Elkhart, Ind.; Purdue, B.S.F., 1951.

Richards, B. C., 1106 W. Sugnet Rd., Midland, Mich.; Univ. of Mich., B.S.F., 1951.

Scherf, J. J., W. State St., W. Lafayette, Ind.; Purdue, B.S.F., 1951.

Schoby, B. F., Wabash, Ind.; Purdue, B.S.F., 1951.

Columbia River Section

Junior Grade

Faris, T. I., Woodburn, Oreg.; Oregon State, B.S.F., 1935.

Johnson, W. R., Forester, U.S.F.S., Portland, Oreg.; Oregon State, B.S.F., 1938.

Southwick, F. L., Dist. Warden, Douglas Forest Protective Assoc., Roseburg, Oreg. (Affiliate, 1944).

Thomasson, G. S., Chairman, Long-Bell Lbr. Co., Vaughn, Oreg.; Univ. of Mo., B.S.A. 1948; Duke, M.F., 1950.

Valentine, R. R., Oregon State College, Corvallis, Oreg.; Oregon State, B.S.F., 1950.

Member Grade

Gurley, W. E., Dist. Rgr., U.S.F.S., Maupin, Oreg.; Oregon State, E.E., 1920; M.F., 1941. (Junior, 1945).

Hammack, B. L., Asst. Tbr. Supt., St. Helens Pulp and Paper Co., St. Helens, Oreg.; Oregon State, B.S.F., 1941. (Junior, 1946).

Kennedy, R. B., Logging Supt., Kinzua Pine Mills Co., Kinzua, Oreg.; Univ. of Wash., B.S.F., 1941. (Junior, 1946).

Kincaid, F. H., Chief Forester, Pope and Talbot, Inc., Oakridge, Oreg.; Oregon State, B.S.F., 1938. (Junior, 1949).

Kirkpatrick, H. W., Commercial Log Scaler, Fir Mfg. Co., Myrtle Creek, Oreg.; Oregon State, B.S.F., 1940. (Junior, 1946).

Mayer, C. E., Field Supv., U.S.F.S., Portland, Oreg.; Iowa State, B.S.F., 1943. (Junior, 1945).

Affiliate Grade

Jackson, G. H., Forester, U.S.F.S., Portland, Oreg.

Jorgensen, C. G., Forester, U.S.F.S., Portland, Oreg.

Associate Grade

Austin, R. C., Research Chemist, Central Research Dept., Crown Zellerbach Corp., Camas, Wash.; Univ. of Wash., B.S., (Chem.), 1933.

Gulf States Section

Junior Grade

Berkley, R. L., Forester, Johns-Manville Products Corp., Bude, Miss.; Univ. of Mo., B.S.F., 1950.

Evenson, C. M., Tech. Foreman, U.S.F.S., Park Falls, Wis.; Univ. of Minn., B.S.F., 1932.

Moran, H. B., Forester, Chicago Mill and Lbr. Co., Greenville, Miss.; Univ. of Mo., B.S.F., 1950.

Rehling, H. W., Asst. Dist. Forester, Texas Forest Service, Conroe, Texas; A.P.I., B.S.F., 1949.

Sykes, C. K., Forester, U.S.F.S., Jackson, Miss.; Univ. of Fla., B.S.F., 1947.

Williams, G. J., Cons. Tbr. Marker, Int. Paper Co., Moss Point, Miss.; Univ. of Idaho, B.S.F., 1950.

Young, E. J., Forest Tech., Int. Paper Co., Natchitoches, La.; Univ. of Mich., B.S.F., 1951.

Member Grade

Norris, F. W., Field Supv., U. S. Gypsum Co., Greenville, Miss.; Univ. of Ga., B.S.F., 1947. (Junior, 1947).

Affiliate Grade

Dantzler, T. H., Dist. Supv., Int. Paper Co., Moss Point, Miss.

Hammond, J. G., Forester, Fernwood Industries, Fernwood, Miss.; Univ. of Kansas, B. S. (Civil Engr.), 1932.

Inland Empire Section

Junior Grade

Dowd, L. W., Soil Cons. Forester, U.S.D.A., Chewelah, Wash.; Iowa State, B.S.F., 1948.

Driver, W. R., Box 542, Lewiston, Idaho; Univ. of Idaho; B.S.F., 1951.

Member Grade

Oft, H. H., Dist. Rgr., U.S.F.S., Walla Walla, Wash.; Oregon State, B.S.A., 1935. (Junior, 1945).

Intermountain Section

Junior Grade

Fielding, J. E., Utah State Agric. College, Logan, Utah; Utah State, B.S.F., 1951.

Member Grade

Packer, P. E., Forester, U. S. Forest Exp. Sta., Idaho City, Idaho; Univ. of Calif., B.S.F., 1939; M.S., 1950. (Junior, 1946).

Watts, G. L., Dist. Forest Rgr., Boise Natl. Forest, Idaho City, Idaho; Univ. of Mich., B.S.F., 1941. (Junior, 1946).

Winkler, O. E., Staff Asst. Forester, U.S.F.S., Logan, Utah; Utah State, B.S.F., 1932; M.S., 1935 (Junior, 1946).

Kentucky-Tennessee Section

Junior Grade

Crail, C. J., 1324 Waterworks Rd., Newport, Ky.; Purdue, B.S.F., 1951.

Watkins, W. P., Staff Forester, Kentucky State Div. of Forestry, Frankfort, Ky.; Pa. State, B.S.F., 1950.

Member Grade

Rider, R. R., Field Agent, Univ. of Ky., Benton, Ky.; Mich. State, B.S.F., 1938. (Junior, 40R46).

New England Section

Junior Grade

Harris, C. E., Forester, Prentiss and Carlisle Co., Inc., Bangor, Me.; Univ. of Me., B.S.F., 1947.

Stulpin, E. J., Park Supv., Me. State Park Comm., Weld, Me.; Univ. of Me., B.S.F., 1950.

Member Grade

McConkey, T. W., Forester, U.S.F.S., Alfred, Me.; Cornell Univ., B.S.F., 1932; M.F., 1933. (Junior, 33R49).

Affiliate Grade

Plumb, A. W., Resident Forester, N.E. Forestry Foundation, Inc., Boston, Mass.

Sargent, L. B., Jr., Cons. Forester, Plymouth, N. H.; Univ. of N. H., B.S.F., 1947.

Tryon, T. C., Chief of Party, James Sewall Co., Old Town, Me.

Associate Grade

Mook, P. V., Assoc. Path., Div. of Forest Path., U.S.D.A., New Haven, Conn.; Univ. of Md., M.S., (Botany), 1928.

New York Section

Member Grade

Parmelee, S. R., Resident Mgr., Draper Corp., Tupper Lake, N. Y.; N. Y. State, B.S., 1940; M.F., 1942. (Junior, 1946).

Weight, F. F., Forester, Cons. Dept., State of N. Y., Albany, N. Y.; N. C. State, B.S.F., 1930. (Junior, 34R50).

Northern California Section

Junior Grade

Burton, J. D., Forester, U.S.D.A., Northfork, Calif.; W. Va. Univ., B.S.F., 1949; Yale, M.F., 1950.

Carlson, C. E., Asst. Tech., Div. of Forestry, Sacramento, Calif.; Univ. of Idaho, B.S.F., 1936.

Carlson, F. J., Jr., 371 30th St., Oakland, Calif.; Univ. of Calif., B.S.F., 1951.

Goldsmith, W. H., Tbr. Cruiser, Georgetown Lbr. Co., Georgetown, Calif.; Univ. of Idaho, B.S.F., 1949.

Gustafson, R. W., Supv. Control Aid, U.S. D.A., Berkeley, Calif.; Univ. of Calif., B.S.F., 1950.

Hastings, L. C., Mgr., Resources Dept., Paul Bunyan Lbr. Co., Susanville, Calif.; Princeton Univ., A.B., 1935. (Affiliate, 1946).

Heyden, R. E. C., Jr., 1110 Harvard Rd., Piedmont, Calif.; Univ. of Calif., B.S.F., 1951.

Lofgren, J. O., 1864 Willowside Rd., Santa Rosa, Calif.; Univ. of Calif., B.S.F., 1951.

Nichols, E. E., Box 849, Mt. Shasta, Calif.; Oregon State, B.S., 1951.

Reynolds, R. D., International House, Berkeley, Calif.; Univ. of Calif., B.S.F., 1951.

Sorber, R. P., 2742 College Ave., Berkeley, Calif.; Univ. of Calif., B.S.F., 1951.

Member Grade

Bryan, S. H., Forester, Associated Lbr. and Box Co., Wilseyville, Calif.; Univ. of Calif., B.S.F., 1943. (Junior, 1945).

Emmert, F. C., Forester, Pine Logging Co., Fresno, Calif.; Univ. of California, B.S.F., 1937. (Junior, 1946).

Grogan, G. R., Forest Tech., Calif. Div. of Forestry, Redding, Calif.; Univ. of Mich., B.S.F., 1939. (Junior, 1946).

Horn, M. J., Dist. Forest Rgr., U.S.F.S., North Fork, Calif.; Oregon State, B.S.F., 1936. (Junior, 1948).

James, W. C., Forester, Dept. of Interior, San Francisco, Calif.; Colo. A. & M., B.S.F., 1936. (Junior, 1947).

Keast, F. W., Asst. State Forest Rgr., Calif. Div. of Forestry, Academy, Calif.; Univ. of Calif., B.S.F., 1947. (Junior, 1948).

Sechrist, E. E., Jr., Forest Tech., Calif. Div. of Forestry, Sacramento, Calif.; Univ. of Calif., B.S.F., 1941. (Junior, 1945).

Tackle, D., Forester, U.S.F.S., Calif. Forest and Range Exp. Sta., Berkeley, Calif.; Univ. of Calif., B.S.F., 1946. (Junior, 1947).

Affiliate Grade

Columbro, C., Assoc. State Forest Rgr., Div. of Forestry, Santa Rosa, Calif.

Associate Grade

Gray, C. T., Gen. Mgr., Stockton Box Co., Stockton, Calif.

Mitchell, H. L., Supv. Control Aid, U.S.D.A., Bureau of Entomology, Berkeley, Calif.; Oregon State, B. S., (Forest Ento.,), 1950.

Northern Rocky Mountain Section

Junior Grade

Hall, W. S., Jr., Engr. Aid, U. S. Soil Cons. Service, Kalispell, Mont.; Colo. A & M., B.S.F., 1950.

Leaphart, C. D., Plant Path., Div. of Forest Path., Missoula, Mont.; Mont. State, B.S.F., 1948; Yale, M.F., 1950.

Member Grade

Grambo, E. J., Dist. Rgr., U.S.F.S., Rexford, Mont.; Wash. State, B.S.F., (Junior, 1947).

Phillip, M. F., Dist. Rgr. U.S.F.S., Philipsburg, Mont.; Mont. State, B.S.F., 1940. (Junior, 1947).

Ozark Section

Junior Grade

Bruns, R. R., 6611 Bancroft, St. Louis, Mo.; Univ. of Mo., B.S.F., 1951.

Deed, R. N., Forest Tech., Int. Paper Co., Arkadelphia, Ark.; Univ. of Mo., B.S.F., 1950.

Dressel, A. T., Tech., In. Paper Co., Arkadelphia, Ark.; Univ. of Mo., B.S.F., 1950.

Edscorn, K. C., Treating Supv., Mo. Pacific Railroad Co., Kansas City, Mo.; Univ. of Mo., B.S.F., 1950.

Glaser, E. H., Farm Forester, Mo. Cons. Comm., Van Buren, Mo.; Univ. of Mo., B.S.F., 1949; M.F., 1950.

Lashley, O. L., Tbr. Mgmt. Aid, U.S.F.S., Rolla, Mo.; Univ. of Mo., B.S.F., 1951.

Lodge, G. W., Jr., Compassman, Int. Paper Co., Sheridan, Ark.; Univ. of Mo., B.S.F., 1950.

Matt, L. E., 1329 Belton Ave., Webster Groves, Mo.; Univ. of Mo., B.S.F., 1950.

Moeller, C. A., Jr., 6310 Marty, Overland Park, Kansas; Univ. of Mo., B.S.F., 1950.

Schildknecht, J. R., Mgr. Trainee, Long-Bell Lbr. Co., Enid, Okla.; Univ. of Mo., B.S.F., 1950.

Schweitzer, F. J., Jr., Forester, Dierks Lbr. and Coal Co., Mt. Pine, Ark.; Univ. of Mo., B.S.F., 1950.

Stevenin, H. L., 7038 Chestnut St., Kansas City, Mo.; Univ. of Mo., B.S.F., 1951.

Welch, H. D., Jr., 129 E. 8th St., Cameron, Mo.; Univ. of Mo., B.S.F., 1951.

Wood, E. B., Forestry Consultant, Cloud Oak Flooring Co., Westplains, Mo.; Univ. of Mo., B.S.F., 1950.

Member Grade

Burwell, J. C., Resident Forester, Dierks Lbr. and Coal Co., Broken Bow, Okla.; Univ. of Mich., B.S.F., 1939. (Junior, 1947).

Markell, M. L., Jr., Dist. Forester, Ark. Div. of Forestry, Dierks, Ark.; Univ. of Ga., B.S.F., 1943; Duke Univ., M. F., 1947. (Junior, 1946).

Schmidt, A. H., Field Man. Freeman Stave Co., Inc., Kirkwood, Mo.; Pa. State, B.S.F., 1934. (Junior, 1949).

Puget Sound Section

Junior Grade

Dobbins, F. D., Company Forester, H and H Pole and Piling Co., South Bend, Wash.; Univ. of Wash., B.S.F., 1949.

Larson, W. O., Carnation Mill Farm, Carnation, Wash.; Univ. of Wash., B.S.F., 1942.

Smith, R. A., Fire Control Aid, Div. of Forestry, U.S.D.I., Fairbanks, Alaska; Iowa State, B.S.F., 1950.

Stevens, G. J., Forester, U.S.D.I., Yakima Indian Reservation, Toppenish, Wash.; Univ. of Mich., B. S. F., 1950.

Storkman, A. A., Forest Asst., St. Paul and Tacoma Lbr. Co., Tacoma, Wash.; Univ. of Wash., B.S.F., 1950.

Warner, L. H., Fire Control Aide, U.S.F.S., Naches, Wash.; Univ. of Wash., B.S.F., 1950.

Southern California Section

Junior Grade

Cobb, D. L., Tbr. Marker, Winton Lbr. Co., Martell, Calif.; Univ. of Calif., B.S.F., 1951.

Feuchter, R. W., 1211 S. Genesee Ave., Los Angeles, Calif.; Univ. of Calif., B.S.F., 1951.

Maben, R. L., 4536 Grand Ave., La Canada, Calif.; Univ. of Calif., B.S.F., 1951.

Southwestern Section

Junior Grade

Jirsa, D. E., Forestry Aide, U.S.F.S., Winslow, Ariz.; Iowa State, B.S.F., 1950.

Palmer, H. S., Forester, U.S.F.S., Holbrook, Ariz.; Iowa State (4 yrs.).

Member Grade

Wilson, K. O., Regional Fire Chief, U.S.F.S., Albuquerque, N. Mex.; Oregon State, B.S.F., 1937. (Junior, 1947).

Upper Mississippi Valley Section

Junior Grade

Coyer, E. L., 618 Wall St., Mankato, Minn.; Univ. of Minn., B.S.F., 1950.

Hamilton, J. W., Forester, Iron Range Res. and Rehab., Littlefork, Minn.; Univ. of Minn., B.S.F., 1950.

Washington Section

Affiliate Grade

Duvendack, G. H., Communications Officer, U.S.F.S., Washington, D. C.; Colorado School of Mines (2 Yrs.).

Wisconsin-Upper Michigan Section

Junior Grade

Hall, F. C., 6166 N. Kent, Milwaukee, Wis.; Purdue, B.S.F., 1951.

Moran, J. J., Cruiser, Nekoosa-Edwards Paper Co., Port Edwards, Wis.; Univ. of Mich., B.S.F., 1950.

Satterlund, D. R., Box 95 Cumberland, Wis.; Univ. of Mich., B.S.F., 1951.

Seybold, W. H., Research Asst., Griffith State Nursery, Wisconsin Rapids, Wis.; Purdue, B.S.F., 1951.

Sweningson, R. T., Box 13, Peshtigo, Wis.; Univ. of Mich., B.S.F., 1951.

Member Grade

Rogers, F. J., Forester, Nekoosa-Edwards Paper Co., Port Edwards, Wis.; Mich. College of Mining and Tech., B.S., (Forestry), 1943. (Junior, 1947).

Affiliate Grade

Allhiser, A. F., Log and Pulpwood Buyer, Marathon Corp., Rothschild, Wis.

Foreign

Member Grade

Klemme, M., Range Mgmt. Advisor, F.C.A., c/o Postmaster, N. Y., N. Y.; Univ. of Wash., B.S.F., 1930; Yale, M.F., 1935. Reinstatement.

Candidates Elected

The following persons were elected to the indicated grades of membership by the Council on March 1, 1951.

Junior Grade

Abraham, D. B.
Anderson, J. F.
Bacon, D. B., Jr.
Banks, W. G.
Bennett, S. M.
Cameron, D. C.
Conklin, L. D.
Curry, W. L.
Decur, C. J.
Dugan, C. M.
Dunn, G. A.
Dunn, R. W.
Durand, M. N.
Eastman, J. T., Jr.
Erickson, P. E.
Evans, J. T.
Gascon, R. J., Jr.
Grubb, J. E.
Hauer, J. W.
Haynes, J. A.
Hertel, H. G.
Jacobson, C. H.
Jennings, W., Jr.
Jones, T. R.
Kovner, J. L.
Larson, P. R.
Lendman, F. N.
Lowery, D. F.
Martin, J. W.
Miller, J. G.
Nicholson, J. C.
Paull, J. T.
Paulnell, L. K.
Quillinan, A. R., (re)
Richardson, J. W.
Sorseth, A. L.
Stokes, R. E.
Whipkey, R. Z.
Willey, R. M.
Williams, W. K.

Member Grade

Atkinson, S. G.
Bamford, G. T.
Beam, R. C.
Bourget, A. M.
Brann, E. K.
Bronson, V. D.
Burgtorf, C. E.
Burleigh, C. A.
Burns, R.
Byers, J. B.
Carpenter, W. W.
Chamblee, G. V.
Cowan, F. W.
Custer, S. A.
Danson, R. O.
Dengler, R. H.
Dugan, R. F.
Elmgren, R. C.
Fortgang, D.
Goodmonson, P. N.
Goodwin, O. C.
Griffith, B. T.
Hall, C. R.
Herlevich, J.
Hubbard, J. B.
Hummel, D. L.
Jaeger, J.
Jaenicke, R. W.
Johnson, H. E.
Johnson, R. S.
Jollay, T. M.
Kemper, R. C.
Kennedy, R. F.
Kolbe, R. M.
Krause, P. A.
Lange, R. W.
Larson, J. E.
Larson, R. W.
Limpert, C. E.
Lindsay, R. C.
Love, D. B.
Marshall, L. T.
Marshburn, W. J., Jr.
McNaughton, F. H.
Melton, R. E.
Merrill, A. H.

Miller, H. B.
Murchison, G. H.
Murnen, E. J., Jr.
Myers, C. A., Jr.
Olin, D. D.
Olmstead, N. W.
Osterhout, E. J.
Pierson, R. K., (re)
Ralston, J. G.
Rettberg, H. C.
Roberts, A. M.
Roy, D. F.
Ryan, J. C.
Shadduck, A. M.
Smith, G. E.
Snodgrass, J. D.
Stankiewicz, M. J.
Start, W. D.
Steigerwaldt, E. F.
Suominen, R. A.
Switzer, A. K.
Terry, H. L.
Therrell, J. S.
Tippner, E.
Tucker, B. H.
Vance, P. N.
Williston, H. L.
Winger, H. S.
Wishart, J. E.
Wolcott, R. W.
Wright, G.

Affiliate Grade

Clark, J. N.
Hickle, R. C.
Higgins, R. R.
Jones, A. W.
Pyles, H.
Rosar, J. F.

Associate Grade

Wilsey, L.

New Members and Advancements

The new members and members advanced in grade who are listed below are eligible for participation in activities of the Society of American Foresters, including the meetings and projects of Sections, Chapters, Divisions, and Committees. They have submitted their applications for membership, properly endorsed, and have been declared eligible by the Council. By accepting election, these members have indicated their desire to assist the Society in the fulfillment of its objectives.

Allegheny Section

Student Grade

Pennsylvania State College
Getz, J. R.

Junior Grade

Corley, J. C., Phillippi, W. Va.
Keller, F., Portage, Pa.
McAninch, G. E., Strattanville, Pa.
Payne, H. H., 4653 Air Base Squadron, Dover, Del.
Smith, E. A., 44 Ewing St., Trenton, N. J.

Affiliate Grade

Beck, C. A., 325 Maryland Ave., Western Port, Md.

Appalachian Section

Junior Grade

Safley, J. W., 131 Navajo Trail, Portsmouth, Va.

Central Rocky Mountain Section

Member Grade

Kreutzer, W. R., 426 Peterson St., Ft. Collins, Colo.
Philips, R., 1001 Pearl St., Denver, Colo.

Central States Section

Student Grade

Michigan State College
Baumgartner, L. P.
Bloomer, A. W.
Burns, F. H.
Carota, N.
Carpenter, E. M.
Easex, B. L.
Henriksen, W. A.
Kickbusch, W. L.
Larsen, H. S.
Lawrence, G. G.
Long, M. G., Jr.
McCullough, S. W.
Ovellette, C. G.
Sherrill, B. C.
Smalley, G. W.
Sprenger, G. E.
Striffler, W. D.
Sulskis, A.
Tarbox, G. L., Jr.
Thornton, D. L.
Viele, D. H.
Walters, R. S.

Junior Grade

Anderson, L. E., 708 Chestnut Rd., E. Lansing, Mich.
Bassl, C. O., 415-B Willow Lane, E. Lansing, Mich.
Borgerson, H. V., Dist. Forester, Roscommon, Mich.
Goebel, G. E., Hillsboro, Ill.
Hayford, C. G., Rockport, Ind.
Young, G. E., 917 Seymour Ave., Lansing, Mich.

Corresponding Grade

Badran, O. A., Box 432, Ann Arbor, Mich.

Columbia River Section

Junior Grade

Bullard, W. E., Jr., 1405 N. E. 74th St., Portland, Oreg.
Burns, D. E., Box 586, Medford, Oreg.
Dixon, H. S., 1421 W. 12th St., Bend, Oreg.
Lickett, T., 318 W. 1st Ave., N., Roseburg, Oreg.
Schmitt, R. H., U.S.F.S., Prineville, Oreg.
Warman, D. A., U.S.F.S., Glide, Oreg.

Member Grade

Hult, G. W., 3029 Johnson St., Corvallis, Oreg.

Gulf States Section

Student Grade

Louisiana State University
Baldwin, M. S., Jr.
Carroll, R. L.
Chick, H., III
Oakes, C. W.
Sibley, R. C.
Walton, R. A.
Williams, T. D.

Junior Grade

Jameson, D. E., Box 89A, Jackson, Miss.
Roye, A. O., Rt. 2, Baton Rouge, La.

Member Grade

Fender, D. E., Box 587, Nacogdoches, Tex.
Robertson, C. W., Box 94, Natchitoches, La.

Affiliate Grade

Welch, H. E., 828 Eastview St., Jackson, Miss.
Wright, L. Q., 17 Monticello St., Hazlehurst, Miss.

Intermountain Section

Junior Grade

Grimes, P. D., U.S.F.S., Emmett, Idaho
Pates, R. K., Box 804, Burley, Idaho

New England Section

Student Grade

Yale University
Hartley, M. E., Jr. Kissick, N. L.

Junior Grade

Reiske, R. F., 68 William St., Wallingford, Conn.

Member Grade

Abbott, H. G., Petersham, Mass.
Smith, D. M., Yale School of Forestry, New Haven, Conn.

Associate Grade

Gruen, E. D., Amos Tuck School, Hanover, N. H.

New York Section

Student Grade

State University of New York
Bates, J. D.
Bockes, O. D.
Bronson, E. W.
Cameron, G. P.
Coats, K. W.
Egan, P. H.
Fry, D. H.
Goodrich, R. S.
Hadley, D. L.
Hudson, H. H.
Lowe, W. B.
McKee, C. A.
Merrick, J. W.
Miller, J. F.
Patterson, W. C.
Robillard, W. G.
Rodihan, W. F.
Shimer, R. J.
Taylor, T. A.

Junior Grade

Burgess, A. W., 1055 Seneca St., Buffalo, N. Y.
Dronzek, J. J., 264 Commerce St., Hawthorne, N. Y.
Saunders, R. C., Box 315, Hyde Park, N. Y.
Schneider, J. E., 620 W. Onondaga St., Syracuse, N. Y.

Member Grade

Benson, R. W., R.D., #2, Manlius, N. Y.
Mullin, R. E., Box 361, Kemptville, Ontario, Canada

Northern California Section

Junior Grade

Brown, R. L., 2708 Channing Way, Berkeley, Calif.
Hall, D. O., 340 Palo Alto, Mountain View, Calif.
Saukko, R. W., 2837 A St., Eureka, Calif.
Schori, M. O., State Div. of Forestry, Auburn, Calif.
Seamount, D. T., 2024 Haste St., Berkeley, Calif.
Spurgeon, S. E., U.S.F.S., Quincy, Calif.
Zink, H. E., Forester, Happy Camp, Calif.

Member Grade

Schubert, G. H., Calif. Forest and Range Exp. Sta., Berkeley, Calif.

Affiliate Grade

Weselsky, J. W., Rt. 1, Nevada City, Calif.

Northern Rocky Mountain Section

Student Grade

Montana State University
Bacon, C. A.
Campbell, D. G.
Chamberlain, J. E.
Emerson, J. L.

Junior Grade

Moore, W. R., 1706 S. 13th St., Missoula, Mont.

Member Grade

Fulton, L. R., Box 455, Libby, Mont.

Ozark Section

Junior Grade

Canter, E. H., 303 S. Wood, Fredericktown, Mo.
McCombs, R. N., Box 20, California, Mo.

Puget Sound Section

Junior Grade

Devoe, A. H., 2616 21st Ave., N.E., Seattle, Wash.
Dickinson, F. L., Rt. 1, Clearwater, Wash.
Mounteer, R. W., Box 480, Anchorage, Alaska
Rave, R. A., Star Rt. #1, Chehalis, Wash.

Southeastern Section

Junior Grade

Fickett, S. B., Jr., Box 36, Gulf Hammock, Fla.
Harper, W. C., Box 294, Hinesville, Ga.
Harrell, H. P., 1011 Marshall Ave., Augusta, Ga.
Hicks, N. M., Asplund Tree Expert Co., Atlanta, Ga.
Martinez, E. J., Jr., 940 Hickman Rd., Augusta, Ga.
Rogers, J. W., Box 96, Naples, Fla.
Schaeffner, J. F., 1015 S. W. 3rd Ave., Gainesville, Fla.
Sullivan, W. C., McCaysville, Ga.
Tucker, J. J., Box 1237, Albany, Ga.

Southern California Section

Junior Grade

Glunt, T. E., 244 S. Euclid Ave., Upland, Calif.
Malain, R. J., 5933 Fidler Ave., Bellflower, Calif.

Upper Mississippi Valley Section

Student Grade

Iowa State College
Campbell, D. C.
Dale, J. E.
Ehrlich, G. H.
Lang, J. W.
McMillan, F. W.

University of Minnesota
Corson, P. F.
Peterson, A. A.
Rowe, R. W.
Torgerson, K. G.

Junior Grade

Sanderson, W. J., Box 374, Park Rapids, Minn.
Stephens, V., Marcell, Minn.

Member Grade

Runkel, S., Box 630, Ottumwa, Iowa

Affiliate Grade

Gorence, J., 1208 E. Howard St., Hibbing, Minn.
Leersen, O. F., Box 253, Loman, Minn.

Washington Section

Member Grade

Flick, F. J., 1650 Harvard St., Washington, D. C.

Wisconsin-Upper Michigan Section

Junior Grade

Berndt, H. E., Forest Protection Headquarters, Tomahawk, Wis.

Member Grade

Bourdo, E. A., Jr., 204 Vivian St., Houghton, Mich.
George, L. E., 338 E. Columbian Ave., Neenah, Wis.
Marts, R. O., U. S. Forest Products Lab., Madison, Wis.
Swanson, A. L., Box 182, Quinnesec, Mich.
Upton, N. W., 421 6th Ave. S., Park Falls, Wis.

Affiliate Grade

Fowler, S. J., Box 123, Neopit, Wis.

Foreign

Corresponding Grade

Moilanen, T., Toolonk 14 A., Helsinki, Finland

Section Officers

(As of April 1, 1951. Dates terms began are given.)

Allegheny Section

2-17-51

Maurice K. Goddard, Chairman
Pennsylvania State Forest School, Mont Alto, Pa.
D. E. Hess, Vice Chairman
Glatfelter Pulpwood Co., Murphy Bldg., Gettysburg, Pa.
J. Howard Mendenhall, Secretary-Treasurer
405 F & M Building, West Chester, Pa.
D. E. Hess, Membership Chairman
Glatfelter Pulpwood Co., Murphy Bldg., Gettysburg, Pa.
Chapters:
1. New Jersey
2. West Virginia

Appalachian Section

2-12-51

Theodore Davis, Chairman
Forestry Department, Champion Paper & Fibre Co., Canton, N. C.
George W. Dean, Vice Chairman
Virginia Forest Service, Charlottesville, Va.
Roger W. Wolcott, Secretary-Treasurer
Box 2582, Raleigh, N. C.
George W. Dean, Membership Chairman
Virginia Forest Service, Charlottesville, Va.
Chapters: None

Central Rocky Mountain Section

5-13-50

Ralph R. Hill, Chairman
U. S. Forest Service, Denver 2, Colo.
Ralph C. Bryant, Vice Chairman
School of Forestry and Range Management, Colorado A & M College, Fort Collins, Colo.
Warren M. Tracy, Secretary-Treasurer
U. S. Forest Service, Denver 2, Colo.
Ralph C. Bryant, Membership Chairman
School of Forestry and Range Management, Colorado A & M College, Fort Collins, Colo.
Chapters. 1. Black Hills

Central States Section

9-22-50

Warren W. Chase, Chairman
University of Michigan, Ann Arbor, Mich.
Irving I. Dickman, Vice Chairman
Division of Forestry, 1500 Dublin Road, Columbus, Ohio
Charles S. Walters, Secretary-Treasurer
219 New Agriculture Building, Urbana, Ill.
Irving I. Dickman, Memberhip Chairman
Division of Forestry, 1500 Dublin Road, Columbus, Ohio
Chapters: 1. Illinois Technical Forestry Association
2. Indiana
3. Lower Michigan
4. Ohio

Columbia River Section

7-1-50

Clarence Richen, Chairman
4404 N. E. 32nd Place, Portland 11, Oreg.
L. O. Barrett, Vice Chairman
801 W. 8th Street, Vancouver, Wash.
Norman E. Bjorklund, Secretary
West Coast Lumbermen's Association, 1410 S. W. Morrison Street, Portland 5, Oreg.
William S. Phelps, Treasurer
2621 19th Avenue, Forest Grove, Oreg.
Elmer Matson, Membership Chairman
258 N. E. Murry Avenue, Beaverton, Oreg.
Chapters: 1. Central Oregon
2. Hawaii
3. Longview
4. Portland
5. Shasta-Cascade
6. Siskiyou
7. Umpqua-Coquille
8. Willamette

Gulf States Section

5-4-51

James E. Bryan, Jr., Chairman
L. N. Dantzler Lumber Co., Perkinston, Miss.
T. E. Maki, Vice Chairman
Box 122, Gulport, Miss.
John G. Guthrie, Secretary-Treasurer
Illinois Central Railroad, Hattiesburg, Miss.
T. E. Maki, Membership Chairman
Box 122, Gulfport, Miss.
Chapters: 1. Jackson
2. Longleaf
3. North Mississippi
4. Southwest Mississippi
5. North Louisiana
6. Central Louisiana
7. Southeast Louisiana
8. Southwest Louisiana
9. Fort Worth-Dallas
10. Huntsville-Houston-College Station
11. Lufkin-Nacogdoches

Inland Empire Section

5-20-50

M. M. Mosher, Chairman
Department of Forestry, Washington State College, Pullman, Wash.
Earl Ritzheimer, Vice Chairman
Potlatch Forests, Inc., Bovill, Idaho
Floyd W. Cory, Secretary-Treasurer
Box 241, Orofino, Idaho
Hans Roffler, Membership Chairman
U. S. Forest Service, Coeur d'Alene, Idaho
Chapters: None

Intermountain Section

7-1-50

T. W. Daniel, Chairman
Utah State Agricultural College, Logan, Utah
James M. Hockaday, Vice Chairman
U. S. Forest Service, Ogden, Utah
James M. Hockaday, Membership Chairman
U. S. Forest Service, Ogden, Utah
Chapters: 1. Southern and Eastern Utah

Kentucky-Tennessee Section

11-10-50

Maxwell MacMaster, Chairman
Stanley, Inc., Pulaski, Tenn.
Harry Nadler, Vice Chairman
Box 31, Pineville, Ky.
F. Henry Sipe, Secretary-Treasurer
Winchester, Ky.
Harry Nadler, Membership Chairman
Box 31, Pineville, Ky.
Chapters: None

New England Section

2-23-51

William C. MacAdam, Chairman
Francestown, N. H.
R. S. Monahan, Vice Chairman
Hanover, N. H.
Edwin L. Giddings, Secretary-Treasurer
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1-26-51

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7-1-50

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5-1-50

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Chapters: None

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Chapters: None

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6-28-50

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Chapters: None

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11-1-50

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Chapters: None

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3-30-51

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Forestry News

Roy Headley (1879-1951)

Roy Headley, 72, first chief of the Division of Fire Control, U. S. Forest Service, died of a heart attack at his home in Washington, D. C., January 31.

Mr. Headley entered the Forest Service in February 1907 as deputy forest ranger on the Coeur d'Alene National Forest in Idaho. He became deputy supervisor of that forest in August of 1907 and in the fall of that year was made forest supervisor of the Cabinet National Forest in Montana. In 1908 he became chief of the Office of Operation in the regional office in San Francisco, and was promoted to assistant district forester in 1910.

In 1919 Mr. Headley was transferred to the Washington office of the Forest Service as assistant chief forester in charge of the Branch of Operation, and in 1935 he was named the first chief of the Division of Fire Control. He retired June 30, 1942.

Roy Headley was considered an executive and organizer of exceptional ability. An exponent of accountability and responsibility in all public transactions, his influence was felt throughout the Forest Service organization.

As first chief of fire control, he established a systematic plan for the control of forest fires on national forests. To him is due much of the credit for increased efficiency of fire fighting methods and equipment, greater and more widespread application of funds and personnel to fire prevention and control activities, and the development of public attitudes favorable to the fire prevention program.

Radio Features Nation's Tree Farmers

Four Tree Farmers from as many sections of the nation told "why it pays to grow trees as a crop" in a coast-to-coast radio broadcast during the week of February 18.

The Tree Farmers, along with Charles A. Gillett, managing director of American Forest Products Industries of Washington, D. C., were featured in the "Your Business Reporter" show sponsored each week by the National Association of Manufacturers. It was carried by some 200 stations.

H. R. Josephson Chief of Forest Service Economics

H. R. Josephson has been named chief of the Division of Forest Economics, U. S. Forest Service. He succeeds Edward C. Crafts, who recently was made assistant chief of the service.

Mr. Josephson has served as assistant chief of the division since 1945. In his new capacity he will be in charge of forest and range economic research programs including the national survey of forest resources, studies of military and other requirements for wood and wood products, and other investigations of the economic problems of forest land owners and forest industries.

Entering the Forest Service in 1934 at the California Forest and Range Experiment Station in Berkeley, Mr. Josephson carried on investigations in the production, use, and probable requirements for wood products. Later, in cooperation with the Giannini Foundation and state and other federal agencies he conducted investigations on forest land use in the Sierra Nevada foothills.

He resigned from the Forest Service in 1940 to become assistant professor of forest economics at the University of California at Berkeley. At that time he carried on independent investigations of taxation and other problems of timber growing agencies and timber manufacturing industries. Between 1942 and 1945 Mr. Josephson served with the Army Air Force Intelligence Service. He received his BS degree in forestry from Pennsylvania State College in 1932. He received his MS degree in forestry from the University of California at Berkeley in 1933 and his Ph.D. from the same university in 1939.

Roger Anderson on Duke Faculty

Dr. Roger F. Anderson has been named associate professor of forest entomology in the Duke University School of Forestry. He takes the post left vacant by the resignation last September of Dr. James A. Beal who is now with the U. S. Department of Agriculture.

The new Duke faculty member, formerly assistant professor of entomology at the University of Georgia, received his academic training at the University of Minnesota.

State Forester on AFPI Staff

Wilson B. Sayers, state forester of West Virginia has resigned from that position to join the staff of American Forest Products Industries, Inc., Washington, D. C., as administrative assistant to Charles A. Gillett, managing director, effective February 1.

A native Pennsylvanian, Mr. Sayers is a graduate forester, having received his degree in forestry from the Pennsylvania State College. He has had graduate work in plant pathology at Dickinson College, and courses in civil engineering at Bucknell University and photogrammetry at Harvard Forest.

Mr. Sayers is a former assistant professor of silviculture at West Virginia University, and was that state's assistant forester prior to becoming its forester in 1947.

Lakeview Sustained Yield Unit Upheld by Secretary Brannan

The Secretary of Agriculture has upheld the establishment of the Lakeview, Oreg. sustained yield unit, established by the Forest Service on October 10, 1950. The order establishing the unit had been appealed by Willow Ranch Company of Modoc County, Calif.

Purpose of the unit is to stabilize communities of Lakeview and Paisley, which were found to be dependent on timber from the Fremont National Forest. An allowable annual cut of 50 million board feet of timber will be offered for competitive sale with a requirement that manufacture must be in the Lakeview or Paisley communities.

Filipino Foresters Elect Officers for 1951-1952

At its third annual meeting in Manila on January 7, the Society of Filipino Foresters elected the following officers for the 1951-1952 term: Florencio Tamesis, president; Eugenio de la Cruz, vice-president; Valentin Sajor, executive secretary; Evaristo Tabat, treasurer; and Tomas N. Roque, auditor. Incoming council members are: Placido Dacanay, Carlos Sulit, P. San Buenaventura, Felipe R. Amos, Doroteo Soriano, Valentin Sajor, and Luis J. Reyes.

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Demmon Heads Asheville Station, Haig Takes FAO Position

Dr. Irvine T. Haig, director of the Southeastern Forest Experiment Station in Asheville, N. C., left the Forest Service on March 19 to join the Food and Agriculture Organization of the United Nations with headquarters in Rome. Dr. Haig will be in charge of research and technology for the Division of Forestry and Forest Products of FAO. Dr. Haig has directed the Southeastern Experiment Station since July 1944.

He will be succeeded at the Asheville Experiment Station by E. L. Demmon, present director of the Lake States Forest Experiment Station in St. Paul, Minn. Mr. Demmon has been in charge of the Lake States Forest Experiment Station since 1944. From 1928 to 1944 he directed the Southern Forest Experiment Station.

Staff Changes, Washington Institute of Forest Products

Changes on the staff of the Washington Institute of Forest Products are announced by Ralph G. DeMoisy, director.

Promoted from field supervisor, John W. Allen will become assistant director. Mr. Allen supervised the state's inventory of unused wood resources completed December 1950 and wrote the institute's widely used woodlot marketing bulletin.

Mr. Allen holds a master's degree from the University of Washington College of Forestry. Former forester for Portable Lumber Mills, Inc. with three years in the Army Air Force, he has been on the institute staff since its beginning in June of 1949.

Thomas E. Collins, logging engineer for the institute has been called to active duty at Fort Ord, Calif. He is a second lieutenant in the Infantry.

New AFPI Proof Distributed

Newspaper and magazine publishers received in February copies of American Forest Products Industries' 1951 proof book of ready-made forestry ads.

The new publication, the thirteenth of its kind issued in the 10-year history of AFPI, contains 28 different ready-made ads. These are in four, three, and two column sizes. The mats are supplied free, on request. Copy and artwork are designed for use in any section of the country, although individual sponsors may substitute copy specifically designed for local use if they so desire.

Dickerman Named Director Lake States Station

Murlyn B. Dickerman has been appointed director of the Lake States Forest Experiment Station, St. Paul, Minn.

He has been chief of the Division of Forest Economics of the Northern Rocky Mountain Forest Experiment Station, Missoula, since November 1946. He succeeds Elwood L. Demmon, who has been appointed director of the Forest Service's experiment station in Asheville, N. C.

Mr. Dickerman entered the Forest Service in 1934 as a junior forester in Missouri. He served at the Northeastern Forest Experiment Station in Upper Darby, Pa., from 1937 to 1941. During one year of this period he took leave of absence to be plant superintendent of the Otsego Forest Products Cooperative Association in Cooperstown, N. Y. In 1943 he went to the Lake States Forest Experiment Station, where he supervised a census of lumber production and conducted special surveys for the War Production Board.

From 1944 to 1945 he served in the Washington office as liaison between the Forest Service and the OPA in matters relating to forest products. From July 1945 to September 1946 he was a forest specialist with the UNRRA mission in Italy and Greece.

Safe Log Loader

A western development in safe log loading is described in a 7-page circular issued by the Washington Institute of Forest Products, University of Washington, Seattle 5.

The leaflet, No. 11 of the "New Wood-Use Series," is entitled: *The Berger-Rees Air-Tong Loader*. It publishes costs and production rates on the equipment for the first time.

Besides the outstanding safety features of the loader, it is considered especially efficient. One logger, quoted in the circular, stated: "The economy obtained by this method of loading makes possible the continuation of the pre-logging operation, employing 18 men, that otherwise would not be considered if conventional loading methods were used."

Other features include reduced loading time per log, increased control of the log, ease in handling small logs and short chunks, complete mobility and simplified maintenance. The air-tong loader is another of the logging tools developed by northwest forest industry to increase the utilization of its woods resources.

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BETTER TREE SEED—FOR BETTER FORESTS

Dr. Illick to Retire

Dr. Joseph S. Illick has announced his retirement this year from the deanship of State University of New York, College of Forestry. He intends to resume studies in forest administration and forest organizations that he started several decades ago, and to make a critical analysis of forestry education trends.

When he was graduated from Lafayette College in 1907, he took an appointment as instructor in biology at the Pennsylvania State Forest Academy at Mount Alto. He remained three years, then attended the Biltmore Forest School which completed its training of students in Europe. He stayed on at the University of Munich to specialize in forest pathology.

Rejoining the Pennsylvania school's faculty in 1912 as professor of forestry, he was its acting head during 1917-1919, leaving to become chief of silviculture and research for the Pennsylvania Department of Forests and Waters. From 1927 to 1931 he was chief forester of Pennsylvania.

Dr. Illick returned to education when he was appointed professor of forest management at New York State College of Forestry, Syracuse. (He had received the M.S. degree from Juniata College in 1925 and the D.Sc. from Lafayette College in 1927, and already held the Biltmore School's degrees of Bachelor of Forestry and Forest Engineer. At Syracuse Dr. Illick served as head of the Department of Forest Management 12 years until named dean in 1945.

The college, founded in 1911 to serve 250 students, had been expanded with a second building in 1933 to accommodate 500. From a record enrollment of 530 in 1937, enrollment had dropped to a war-depleted 108 when Dr. Illick became dean. It was a period when educational institutions were suffering faculty declines proportional to student declines. But Dr. Illick held together the faculty productively in anticipation of the upsurge in students he knew would come with peace. The college consequently was prepared for the sudden jump to 706 student foresters who enrolled in 1946 (and 865 in 1947 and 876 in 1948).

During his tenure the faculty has grown from 42 members to 74, and the annual budget of the institution has approximately doubled to a figure well over one million. Currently this figure includes research funds of $225,000.

Dr. Illick is the author of 12 books, 10 bulletins, and more than 150 articles on forestry and conservation.

JOSEPH S. ILLICK

Among his books are *Pennsylvania Trees, How to Know the Hardwoods, The State Forests of Pennsylvania, Land Use and Forestry,* and a textbook, *Outline of General Forestry.* He is a Fellow of the Society of American Foresters, and was 1947 chairman of the Society's Division of Education. He helped organize, and served as first head of, the Council of Forestry School Executives.

The College of Forestry is the country's only forestry school with its own board of trustees. At the trustees' request a year and a half ago, he remained as dean beyond his 65th year.

Svenson Heads Lands Division in Milwaukee

Harold A. Svensen has been named chief of the division of recreation, lands, wildlife, range, and water management in the North Central Region, U. S. Forest Service, Milwaukee, Wis.

Mr. Svensen, a forestry graduate of the University of Washington, has had 17 years' experience in the Forest Service. After serving as ranger in Missouri at the time the national forests were being established there, he was stationed at Ironwood, Michigan for 7 years, first in charge of the land purchase program for the Ottawa National Forest and later as assistant supervisor of that forest. In 1942 he was transferred to the Milwaukee regional office in the cooperative forest protection program. From 1943 to 1945, he was supervisor of the Wayne National Forest in Ohio. In May 1945 he was sent to Sweden as agricultural attache for the State Department at Stockholm. Since November 1946 he has been assistant chief in the division he now heads.

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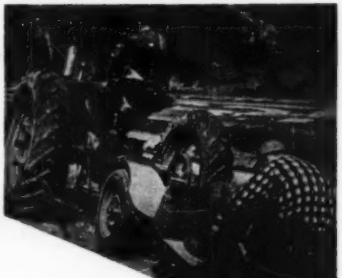

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Essay Contest for Western Forestry Students

The Western Forestry and Conservation Association has announced its 1951 essay contest. Junior forestry students, registered for the fall of 1950 in any of the six accredited forestry schools of Montana, Idaho, Washington, Oregon, California, and British Columbia are eligible to submit essays of between 1500 and 2000 words.

Essays should be submitted to the respective deans by June 1, 1951, who will then select the best essay submitted to each of them and forward it by July 1 to the Western Forestry and Conservation Association in Portland, Oreg.

Each contestant may select the subject of his essay. It should treat a specific aspect of forestry that is of current vital concern. The subject may be either of regional or national interest. It may be in the field of silviculture, forest management, protection, utilization, economics, or administration. Within this sphere would be such subjects as competition in land use, slash disposal problems, economics of artificial reforestation, forest incendiarism, forest taxation reform, etc.

The first prize will be $100; the second prize $75 plus expenses to the Annual Conference of the Western Forestry and Conservation Association, which this year will be in Portland, on November 28-30. Both prize winners will be expected to attend. The winner of the first prize will read his essay to the conference. The two prize-winning essays will be made a part of the published proceedings of the conference.

Bureau of Land Management Promotions

Bryon C. Denny and Irving Senzel of the Division of Land Planning, Bureau of Land Management, have been promoted to fill two new positions, chief, Branch of Land Classification, and chief, Branch of Research and Program Analysis.

The Division of Land Planning formulates and coordinates BLM policies for the maximum beneficial use of the public lands and their resources on approximately 500 million acres of land in the United States and Alaska.

Mr. Denny has had over 15 years' experience with the Departments of Agriculture and Interior on land tenure and utilization problems. For the past eight years, he has specialized in the economic appraisal of public land classifications with the Bureau of Land Management.

Mr. Senzel began his government career in 1938 with the Department of Commerce. In 1939, he transferred to the Department of the Interior's General Land Office, now part of the Bureau of Land Management. As chief of the Branch of Research and Program Analysis, he directs statistical and economic studies in relation to management, protection, and disposal of the public domain.

Trees for Tomorrow Adds Forester

Edward M. Christianson, a forestry graduate of the University of Minnesota, has joined the staff of Trees for Tomorrow, Merrill, Wis. A liaison pilot during World War II, he has been employed as a timber cruiser with the Mosinee Paper Mills, and has worked with U. S. Forest Service in Colorado.

The addition of Mr. Christianson is part of an expansion program undertaken by Trees for Tomorrow to provide greater technical assistance to private forest landowners in preparing long range forest management plans.

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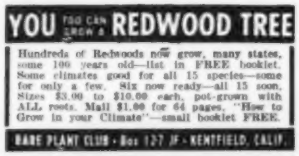
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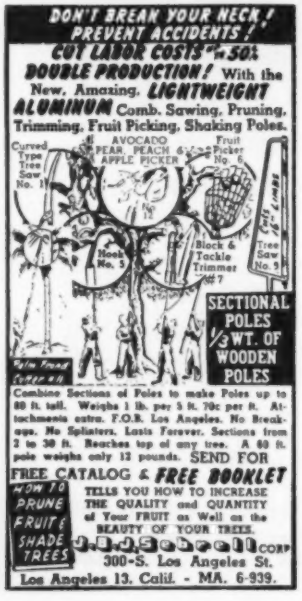
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FPRS Program Will Feature Forestry Problems

Forestry problems will be featured in the fifth annual national meeting and international industry show of the Forest Products Research Society being held at Convention Hall, Philadelphia, Pa., the week of May 7.

A logging and sawmilling show has been arranged to operate in conjunction with the industry show under the direction of Fred C. Simmons, specialist in logging and primary processing of the Northeastern Forest Experiment Station. This show is planned to present a comprehensive exhibition of modern logging and sawmilling techniques, under actual operating conditions wherever possible, which will feature practically everything needed for economical, safe, and high-speed production both in the woods and at the mill, with emphasis on mechanization that may be used to offset the growing shortage of qualified woodsmen and skilled sawmill help.

Canadian and European manufacturers have signified their intension to exhibit their machinery and equipment with that of American manufacturers. Included among these are two Swedish manufacturers of sash gang saws, a Norwegian manufacturer of a circular gang saw, and a Swiss manufacturer of a cableway, a combination high-lead and aerial transportation system, for bringing logs from rough mountain slopes.

American manufacturers plan to demonstrate all types of logging and sawmilling equipment which will include modern versatile many-purpose units designed to handle a variety of jobs on a single investment as well as more highly specialized equipment designed for single high-speed operation. Exhibits are also planned to bring out the value of two-way radio, metal detectors, portable power saws, and wood chippers. It is also planned to display short log mills, bolters and other machinery, and equipment suited to wood waste utilization.

Arrangements are nearing completion for the most elaborate and extensive program of technical sessions with the greatest display of machinery, equipment, and service materials ever attempted by the society. Eight other technical societies, including the Society of American Foresters, are co-sponsoring this event.

Roy M. Carter, chairman of the program committee, is developing the program along three lines: (1) how to utilize modern woodworking machinery and equipment; (2) how to train more productive manpower; and (3) how to conserve resources through better utilization.

Technical sessions will be held on such general subjects as: mobilization of the wood industry; logging and primary processing equipment; new machinery, machineability and methods; glues and gluing; wood fabrication and joint problems; wood fuel and wood fuel conversion; conversion of woods and mill scraps; the role of treated lumber; and training men for the wood industries.

All persons wishing to attend or to exhibit are invited to write for further information to: 1951 Annual Meeting Committee, Forest Products Research Society, 2 Columbus Circle, New York 19, N. Y.

Northwest Tree Production Nears 20 Million Mark

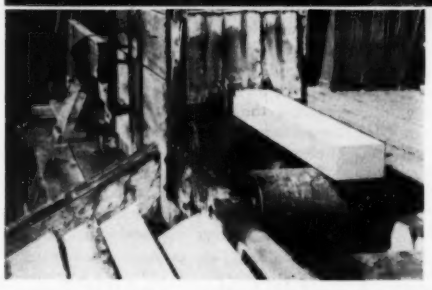
Timber tree nurseries are adding nearly 20 million seedlings this year to the growing stock of Washington and Oregon forests.

A survey by American Forest Products Industries, Inc. shows eight major nurseries in the two states are turning out 19,380,000 trees this season. Last year the same nurseries—six in Washington and two in Oregon—distributed 16,237,500 trees.

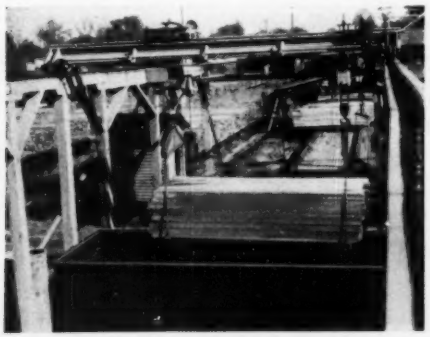
Leading in production both years was the forest industries' nursery at Nisqually, Wash., which distributed 9,054,000 trees, or nearly 56 percent of the two-state total in the 1950-51 planting year. This year Nisqually has a planned output of 7,000,000.

Other forest nurseries tabulated are operated by the two states individually, the U. S. Forest Service, Soil Conservation Service, and the City of Seattle. Pine tree production at Pullman and Bend nurseries is included. Altogether the eight nurseries have a production capacity of 30,650,000 trees a year.

Above is a typical dipping vat located on the green chain. Overhead rollers are used to force the freshly sawn lumber ino the anti-stain solution as it passes through the vat.



Green timbers and larger dimension materials can be sprayed by passing stock on a roller conveyor through a spray box fitted with nozzle or perforated pipes.



At some large mills and concentration yards, an overhead crane system (as pictured above) is used to dip lumber in bulk packages. As much as a truckload at a time can be dipped by this fast and inexpensive method.

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Keener, President, Southern Pulpwood Conservation Assoc.

J. H. Keener, woods manager for the Canton, N. C., division of Champion Paper and Fibre Company, was elected president of the Southern Pulpwood Conservation Association at its annual meeting January 24. A. G. Wakeman, executive vice president and general manager of the Coosa River Newsprint Company, Coosa Pines, Ala., was elected vice president. Mr. Keener, during the past few years, has held offices of director and vice president of the association. R. W. Wortham, Jr., executive vice president of Southland Paper Mills, Inc., Lufkin, Tex., is the retiring president.

The meeting was attended by 300 representatives of member pulp and paper mills, suppliers of pulpwood, industrial and publicly employed foresters, and others interested in forest conservation. In evidence this year was a larger representation of southern bankers, reports H. J. Malsberger, general manager of the association.

The bankers, Messrs. G. G. Ware, T. M. Baker, and Erle Cocke, appearing on the morning program, revealed increasing activities conducted by banks to encourage the wise use of the South's tree crop. The afternoon program was devoted to a discussion by pulp and paper industrial foresters reviewing past industrial forestry activities and outlining actions to be taken today and for the future to maintain and to expand the economy of the South dependent upon its forests.

E. W. Tinker, executive secretary, American Paper and Pulp Association; W. J. Damtoft, assistant secretary and treasurer, The Champion Paper & Fibre Company; and M. H. Collet, assistant to the vice president, West Virginia Pulp & Paper Company, presented these ideas.

The master of ceremonies for the evening program was J. E. McCaffrey, division superintendent, Woodlands Department, International Paper Company, who presented the speaker of the evening, humorist J. D. Arrington.

New Bulletin on Spraying with DDT

Pennsalt's agricultural chemicals department has issued a new service bulletin describing safe methods of spraying shade and ornamental trees with DDT emulsion concentrate.

Many trees that can tolerate DDT are, under certain conditions, susceptible to leaf burn from the solvent with which the insecticide is mixed. To gain the benefit of DDT's effectiveness with safety to trees and shrubs, the amount of solvent applied to a specific leaf surface area must be controlled. The new bulletin, Pennsalt No. 201, gives in tabulated form for quick reference and ease in following directions a list of the host trees, the insect pest causing damage, the amount of spray to be used, and special instructions on how it should be applied.

The booklet is available on request by writing the Agricultural Chemicals Department, Pennsalt Chemicals, 1000 Widener Building, Philadelphia 7, Pa.

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Forester, 42, married. Sixteen years experience with U. S. Forest Service in western states, 13 as district ranger, also timber sales, cruising, and other types forestry experience. Desires permanent position with consultant or private forestry organization. References and detailed information on request.
Box O, Journal of Forestry, Mills Building, Washington 6, D. C.

Nurseryman and forester 51, from northern state desires permanent position managing forest tree nursery in southern state. 25 years experience farm forestry and nursery management. Member SAF. Details on request.
Box S, Journal of Forestry, Mills Building, Washington 6, D. C.

New Box Board from Straw

A box board from straw, to replace critical wood veneer now used in making wire-bound shipping containers for farm and industrial products, was announced February 16 at the annual meeting of the Technical Association of the Pulp and Paper Industry in New York City.

The product is the result of research by the U. S. Bureau of Agricultural and Industrial Chemistry in cooperation with industry. The straw box board was developed by Drs. E. C. Lathrop and T. R. Naffziger working with engineers of the Stapling Machines Company of Rockaway, N. J., who designed, fabricated, and tested boxes made with the board.

A report on this work, prepared by Drs. Lathrop and Naffziger and E. R. Stivers of the Stapling Machines Company, was presented at the TAPPI meeting today by Mr. Stivers.

The straw box board could replace much of the 1.5 billion square feet of wood veneer needed annually for wire-bound boxes. At the same time, according to the report, it could provide a use for some 500,000 tons of straw, which is readily available as part of the country's annual straw surplus, totaling about 40 million tons.

The new board-making process uses standard equipment already employed by or available to the insulating building board industry. The thickness of the straw box board can be varied from a sixth to a quarter inch, depending on the type of box needed for specific uses.

Straw box board does not possess all the physical properties of wood, but tests show that its performance in wire-bound boxes is equally satisfactory. Standard wire-bound boxes made of the new board, containing loads of 100 to 200 pounds, withstood both drop and rough-handling tests as well as boxes made from like thicknesses of wood veneer.

One obstacle the engineers met and overcame was that, although the wires do not cut into wood veneer in a box, they did cut into the straw box board. This problem was solved by putting a metal edging on the board, similar to the edging often used on paper pie plates.

South Mississippi Scouts Trained in Forestry

From Mt. Olive to Pascagoula and from Richton to Gulfport, more than 150 Boy Scouts and leaders from 16 counties of Mississippi received training in the principles of forestry in two camporees sponsored by the Pine Burr Area Council. Held at Camp Towanda near Wiggins, Miss., recently the two events gave the Scouts opportunity to "learn by doing" under the direction of experts from both government and industrial sources, according to J. H. C. Thomas, scout executive.

Tree seedling planting, fire fighting, tree measuring, tree and seed identification, wood identification and uses, tree felling and selective cuttings and burning, and demonstration of modern equipment were features of the training experience. John G. Guthrie, Illinois Central Railroad forester, was in charge of both events.

Other foresters who served as instructors were Dave Bruce, U. S. Forest Service, Southern Forest Experiment Station, Gulfport; James E. Bryan and Scott Moore of the L. N. Dantzler Lumber Co., of Perkinston; Vaden W. Loveless, area ranger, Mississippi Forest Service, Wiggins; and Joe Zary, assistant ranger and W. R. Denton, chief fire control, of the Leaf River District, De Soto National Forest, Brooklyn, Miss.

Conservation Summer School To Hold Second Session

The F. Harold Daniels School of Forestry and Conservation, held at the home of Mr. Daniels in Ruthland, Mass., will have an enrollment of 60 high school and junior college boys during its 1951 season, July 2 to August 25. The school was started last year by the Worcester (Mass.) Natural History Society. It embraces class and field work in forestry, conservation, wildlife management, topography, soils and soil conservation, and forest engineering. Maintenance of a forest nursery and the development of an arboretum are continuing projects.

Objectives of the course are to train youth in fundamental principles of conservation, to help gain experience necessary for choice of careers, to supplement high school courses, to stimulate interest in wise use and protection of resources. Tuition is $50. Applications and detailed information may be obtained from the Worcester Natural History Society, Worcester 8, Mass.

New Nevada Grazing District

Nevada Grazing District No. 6, totaling some 7,367,000 acres of public lands in central Nevada is the last large area on the public lands to be brought under district administration.

The area includes all of Eureka, Lander, and Nye Counties, Nevada, north of the Mount Diablo base line which are not in established grazing districts, Indian reservations, wildlife refuges, or national forests.

Grazing fees in the new district will not go into effect until one year after the district has been established, in order to allow time to organize the advisory board and to obtain basic information on grazing capacity, base property qualifications, and other management data.

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Logging Leftovers

Nearly 210 million cubic feet of unused wood resources, representing 50 million payroll dollars, are available annually in the State of Washington, the Institute of Forest Products reports in a summation of its inventory of leftover wood.

Equivalent to more than 800,000 tons of wood pulp, the material accessible to tidewater alone would support five kraft paper mills. On a statewide basis it would produce 140 million gallons annually of industrial alcohol, now a critical item.

The publication, *Summary Report No. 1*, reveals by colored maps and graphs valuable facts and figures never before available on the amount, location, and accessibility of unused wood supplies in the state.

"The basic purpose of the inventory is to assist in the establishment of new wood-using industries and greater payrolls within the state by pointing out sources and annual volumes of available unused raw materials," Ralph G. DeMoisy, technical director of the institute says.

The inventory, requiring 18 months to complete, was initiated by a directive of the state legislature in 1947. Appropriations were made in 1949 to finance the project which was conducted under the active direction of Governor Arthur B. Langlie as chairman of the Forest Products Commission and Jack V. Rogers, director of the Department of Conservation and Development.

Copies of the report and other publications of the institute may be obtained free at 303 Anderson Hall, University of Washington, Seattle 5.

AFPI Adds Field Man in South

American Forest Products Industries has added a second field manager to its southern staff. He is Edward L. De Motte, Montgomery, Ala., newspaperman and magazine publisher.

Prior to this time the South has comprised a single AFPI district with headquarters in New Orleans under District Manager C. Edward Stout.

Mr. De Motte will maintain headquarters at 1033 National Bank of Commerce Building, New Orleans, and will serve the states of Alabama, Mississippi, Louisiana, Arkansas, Texas, Oklahoma, Missouri, and Kansas.

Mr. Stout now becomes southeastern manager and will open a new office in Atlanta. His district will include Georgia, Florida, Tennessee, Kentucky, South Carolina, North Carolina, Virginia, and West Virginia.

Illinois Market Study

Keith Hutchison, marketing research specialist with the Central States Forest Experiment Station, has been assigned to work with Southern Illinois University in preparing a directory of markets for southern Illinois timber.

Although Illinois ranks as one of the leading wood-using states of the nation, Hutchison points out that less than 10 percent of the wood used is home grown. Illinois can supply a much greater share of this industrial wood, he said, and the purpose of the directory is to suggest markets where the Illinois timber may be used.

While vast quantities of Illinois timber is not suitable for the manufacture of furniture and other quality products, it can be used widely in industry.

Hutchison will supervise the compilation of a list of possible users of the southern Illinois timber. When the list is completed, John Hosner, forestry specialist at the University, will distribute a questionnaire to the industries. The results of the questionnaire will be incorporated into the directory.

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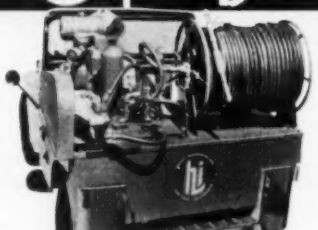

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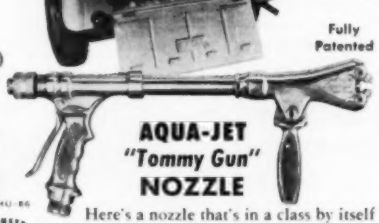

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State Strafes Sawfly

In June 1950 locally severe attacks of red-pine sawfly (*Neodiprion sertifer*), a new introduction to Illinois, were first discovered on plantations in and near the Henderson State Forest. Winter surveys on the forest have revealed abundant egg masses capable of creating epidemic conditions in the forthcoming season. Examination of cocoons in the plantation duff suggests the insect has been present for two or more years.

Control will be attempted by the Illinois Division of Forestry when the larvae appear in May. Using pressure-type hand sprayers and an aeroplane or helicopter, an oil solution of DDT is to be applied to 169 acres of pine plantations. Planning and execution is under the direction of District Forester Wayne Ashby and Staff Forester Don Larson with special assistance from Daniel M. Benjamin, entomologist, of the U. S. Bureau of Entomology and Plant Quarantine.

The red-pine sawfly first appeared in the United States near Somerville, N. J. in 1925. Subsequently, it has migrated westward into Ohio, Michigan, and into southern Ontario. Its discovery on the Henderson State Forest marks an enlargement of its range to the east bank of the Mississippi River.

Not all species of pine are affected on this forest at this time. Heavy egg populations are present on Japanese red pine, shortleaf pine, ponderosa pine, red pine, and pitch pine.

West Virginia Conservation Camp

The ninth annual conservation camp, sponsored by the Conservation Commission of West Virginia and other agencies, will be held June 4 to 9. Attendance will be limited to 200 campers and 40 instructors.

I. B. Boggs, of the agricultural extension service, West Virginia University, will be director of the camp, and G. H. Overholt, of the West Virginia Forest Fire Protective Association, assistant director. Secretary is Ralph H. Quick, chief of the conservation commission's education and publicity division.

Forest protection and applied forestry will be taught and the camp schedule will include a state parks and state forests study program. Other subjects will include fish management, nature study, soil and water conservation, youth conservation, care and use of firearms, fishing tackle, archery, fly tying, and camp crafts.

In addition to the conservation commission and the West Virginia Forest Fire Protective Association, sponsoring agencies are: agricultural extension service, West Virginia University, division of vocational education, State Department of Education, Federal Cartridge Corporation, U. S. Soil Conservation Service, West Virginia Garden Club, Monongahela Power Company, sportsmen's clubs, and the U. S. Forest Service.

Eldon H. Myrick Retires

Eldon H. Myrick, supervisor of the Lolo National Forest at Missoula, Mont., for the past 16 years, retired February 28, after more than 38 years with the U. S. Forest Service, all in the Northern Region. His successor as supervisor of the Lolo will be Chalmer K. Lyman, at present assistant forest supervisor of the Lewis and Clark National Forest at Great Falls, Mont.

Mr. Myrick, a native of Kansas, studied forestry at the University of Idaho. He was first employed by the Forest Service on the Coeur d'Alene National Forest in Idaho in 1912.

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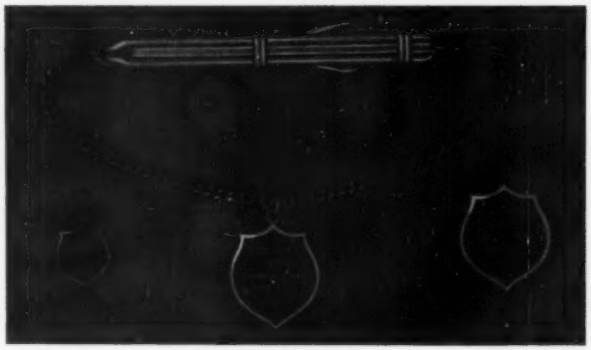

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Southern Agricultural Workers Meet

The 48th annual meeting of the Association of Southern Agricultural Workers was held in Memphis during February 5-7.

As is customary, the Forestry Section held meetings. N. B. Goebel, chairman, and C. E. Clapp, vice chairman, conducted these sessions.

James S. Therrell presided at a session on tree crops at which Carl Ostrom described progress in breeding and seed selection of southern pine.

A joint session of the Forestry Section was held with the Section on Agricultural Economics. William C. Duerr presided. Papers were given by Ralph Marquis and N. T. Barron.

At the final forestry meeting T. Russell Moberg presided. Talks were given on various aspects of hardwood management and utilization by W. Foster Cowan, Russell Stadelman, H. L. Person, Paul R. Kramer, and Roy Carter.

The foresters visited the plant of Nickey Brothers, Inc. under the guidance of Samuel M. Nickey and Russell Stadelman. They saw demonstrations of plywood, flooring, and press-to-log production, and visited the national hardwood lumber inspection school.

New officers of the Forestry Section were elected, as follows:

Chairman, Cecil E. Clapp, U. S. Forest Service, Atlanta, Ga.

Vice Chairman, Wilbur B. DeVall, Alabama Polytechnic Institute, Auburn, Ala.

Secretary, James S. Therrell, Mississippi Extension Service, State College, Miss.

Fellowships Available at Michigan State College

The board of trustees of the Alumni Fund of the Michigan State College has established seven predoctoral Alumni Fellowships ranging in value from $800 to $1,200 per year. Fellows are exempt from student tuition fees. Applications are invited by the dean of the Graduate School, Michigan State College, East Lansing, before May 15, 1951, from graduate students, either resident or nonresident, who wish to pursue a course of study for the Ph.D. degree. One postdoctoral Alumni Fellowship, $3,000 per year, is also available for research in any special field for which the Michigan State College has appropriate facilities.

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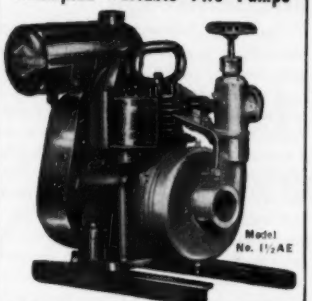

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Tree Planting on Private Lands Increases

Tree planting by private land owners during fiscal year 1950 brought the total acreage of reforested land in this country to 7,200,000 acres, according to the U.S. Forest Service.

During the year ending June 30, 1950 an estimated 497,500 acres of land in the United States, Puerto Rico, and Hawaii were planted to trees as compared to 364,300 acres planted in 1949.

Of the 1950 total, 397,700, or 73 percent, of the planted acres are owned by private individuals or organizations. This represents an increase of 131,300 acres over the 1949 plantings on private lands.

Reports from federal agencies engaged in tree planting activities show a drop in reforestation on publicly owned land. In 1949 the Forest Service, Soil Conservation Service, Tennessee Valley Authority, and the Department of Interior reported a total planting of 59,000 acres. For fiscal year 1950 the same agencies reported a total of 50,500 acres planted.

The acreage planted by other public agencies, such as states, counties, towns, and schools, on non-federal public lands more than doubled, rising from 22,500 acres in 1949 to 49,400 acres in 1950.

Causes for the spectacular rise in planting on private lands, state and federal foresters believe are:

First, state forest nurseries made available approximately 30 percent more growing stock in 1950 than in 1949, bringing the total number of trees distributed close to 300 million.

Second, aggressive tree planting campaigns have been carried on by private and governmental agencies. Besides Forest Service activities, Soil Conservation Service has promoted tree planting as a means of erosion control in 2,100 of its districts. The Extension Service has stimulated interest in the young people through 4-H Clubs. Funds are provided through the Smith-Hughes Act for teaching forestry through forest management in vocational agriculture high schools.

Industry has promoted "Trees for Tomorrow" programs and tree farm projects. Pulp and paper companies have given away thousands of trees free of charge. Railroads have aided the tree planting program by hiring foresters to promote tree planting campaigns, and one even designed a tree planting machine and gives the design to people who want to build one. In some cases the equipment itself was loaned to individuals. The Illinois Central, the Seaboard, and the Northwestern lines have been exceptionally active railroad participants in the tree planting program.

Greatest tree planting activities in 1950 were centered in the South. Leading in reforestration work was Georgia with a total of 55,874 acres planted in 1950. Second was Louisiana with forest plantations on 46,412 acres. Florida placed third in reforestation with 42,949 acres planted.

In the northern sections of the country Michigan was high with 30,668 acres planted in 1950. Oregon turned in an exceptional planting program for the Northwest of 30,002 acres. New York led in the Northeast with 25,370.

Top Price for Illinois Timber

For the second year in succession a white oak tree sale on the Union State Forest, Jonesboro, Ill., has topped the market. State Forester, E. E. Nuuttila, has announced the sale of 102 trees for $5,275. This amounts to $139 per thousand board feet on the stump, Scribner Decimal C Scale. A distilling firm made the purchase for manufacture of barrel staves. The sale last year was for $110 per thousand board feet.

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On his dispatcher's desk, James Camillone set up an AC Portable Carfone—a complete 2-way FM radio like the unit shown above. Then in each car he installed a mobile 2-way Carfone. A simple system. *Yet it provides reliable communication over a 500-square-mile area, 24 hours a day!*

Just one example of how this portable RCA 2-way radio is paying off in transportation, industrial and safety operations. A Pacific coast company uses it to co-ordinate ship unloading. A city in California uses it to control its police and fire-fighting vehicles. A coastal patrol service uses it as a relay in its communication system. It's a natural for forestry and conservation activities in the rapid shifting of equipment and keeping in touch with men at remote points.

For an analysis on the use of 2-way radio in your operations, write Dept. P-151, RCA Engineering Products, Camden, N. J. (*In Canada, write RCA Victor Company Limited, Montreal.*)

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Foresters Incorporate New Utilization Firm

Casswood Industries, Inc., a new sawmilling and forest utilization firm was recently organized in central Illinois near Arenzville, by A. C. Hart, businessman of Arenzville; Nels Glesne, forester formerly with the state of Illinois; Glen Massie and Donald Kulp, foresters formerly with the University of Illinois. Complete and modern logging equipment and trucks have been procured. Work was begun on layout and construction of a modern sawmill and other facilities to be completed in the spring. It will be located on the railroad near Beardstown.

The new company already is doing a thriving business in feltwood. Casswood plans to handle all operations from logging to small-scale manufacturing, including wood preservation, custom tree planting, and forest consultation service. Logs will be purchased by grade. At present, lumber will be air-dried. Ties and other products also will be produced. A commercial-type wood preservation plant is planned to treat products under pressure with pentachlorphenol.

Wherever farm owners are found who are willing to eliminate livestock grazing and fire from their timber and who wish to practice good forestry and land use, their logging will be handled by Casswood Industries, Inc. under a permanent system of timber management which will include periodic harvests to maintain the maximum growth rate and profit per acre for the owner.

More Trees For South Carolina

Backed by the American Legion, a "More Trees" program is underway in every county in South Carolina.

The State Commission of Forestry is assisting the South Carolina Legionnaires in sponsoring the project. American Forest Products Industries, of Washington, D. C., is cooperating in the program and supplying educational materials for distribution to the state's woodland owners.

Cash Crops booklets, designed to tell landowners how to make money harvesting regular crops of trees off their farm woodlots, have been mailed to nearly every farmer in the Palmetto state. An intensive, state-wide program of wood lot management demonstrations and meetings is planned. Specially prepared filmstrips and motion pictures, showing how farm woodlots can be made to pay dividends in the form of regular cash crops of useful wood products, are being shown.

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